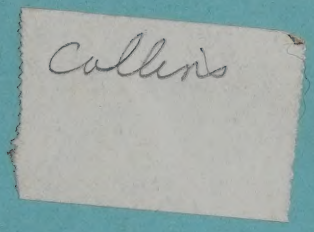
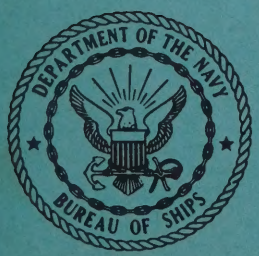
NAVSHIPS 94461

TECHNICAL MANUAL
FOR
RADIO RECEIVER R1150/URR

COLLINS TYPE 50E-7B





BUREAU OF SHIPS · NAVY DEPARTMENT · WASHINGTON 25, D.C.

SYSTEM INSTRUCTIONS

SP-196
15 JUNE 1962

H-F COMMUNICATIONS RECEIVER
50E-7B

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1962

CEDAR RAPIDS, IOWA, U.S.A.

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UNIT INSTRUCTIONS

TD No.	Title
113	Frequency Generator 786E-1
115	Low-Voltage Power Supply 429B-1
497	I-F Translator 786K-1
523	Blower 199M-1
496	Junction Box 153H-3

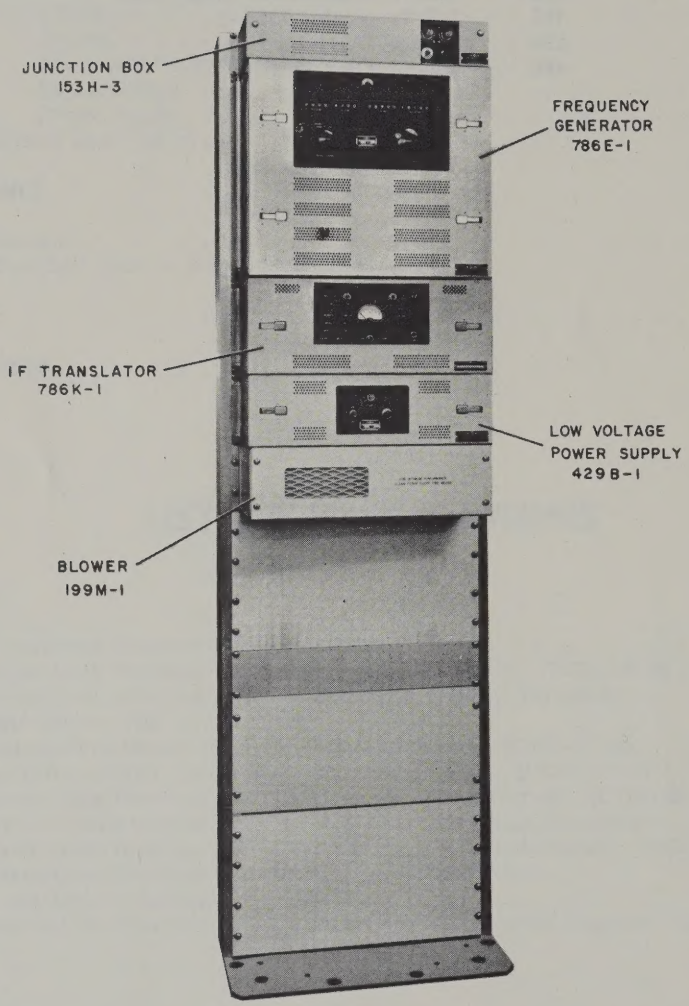


Figure 1-1. H-F Communications Receiver 50E-7B

SECTION I
GENERAL DESCRIPTION

1.1 DESCRIPTION.

H-F Communications Receiver 50E-7B is a manually operated receiver for reception in the 2- to 30-mc high-frequency range. The frequency range of 2 to 30 mc is covered in four bands. The desired operating frequency is set to one-kc increments on a direct-reading frequency counter. Frequency accuracy and stability is determined by the internal reference oscillator frequency standard. The 50E-7B consists of functional units, figure 1-1, mounted in a 70-1/2-inch open-type rack. All power and control interconnections are made in Junction Box 153H-3. Blower 199M-1 supplies filtered cooling air to all units through a central air duct.

1.2 EQUIPMENT SUPPLIED.

Table 1-1 lists the equipment supplied. When mounted, all units extend seven inches from the rack mounting surface. The weight and dimensions listed for each major unit include the chassis and all modules in that unit.

TABLE 1-1. EQUIPMENT SUPPLIED

UNIT	QTY	OVER-ALL DIMENSIONS (inches)			WEIGHT (lb)	COLLINS PART NUMBER
		D	W	H		
50E-7B Receiver	1	20	20-1/2	70-1/2	160.0	522-2944-00
Frequency Generator 786E-1 includes:	1	7	19	15-5/8	43.5	522-0860-00
Frequency Generator Chassis (1)						522-0860-011
Frequency Divider Module (1)						542-7697-004
Stabilized Master Oscillator Module (1)						522-0176-005
Sidestep Oscillator Module (1)						542-1501-004
R-F Tuner Module (1)						546-2148-005
Reference Oscillator Module (1)						542-7729-004
I-F Translator 786K-1 includes:	1	7	19	7	14.0	522-1906-00
AM I-F/A-F Module (1)						543-0276-005
USB I-F/A-F Module (1)						543-0275-005
LSB I-F/A-F Module (1)						543-0274-005
Carrier Generator Module (1)						543-1500-004
Low-Voltage Power Supply 429B-1	1	7	19	6-7/8	33.0	522-0862-003
Junction Box 153H-3	1	7	19	3-1/2	3.0	522-2363-00
Blower 199M-1	1	11-1/4	19	5-1/4	15.0	522-2444-00
Rack Kit						553-2776-00
Air Duct Kit						549-5505-00
Cable Kit						553-2727-00
Shockmount Kit (Optional)	1	18-7/8	21-7/8	2-5/16	75.0	553-4406-00

1.3 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

H-F Communications Receiver 50E-7B is a complete h-f communications receiver requiring only headphones or speaker and an antenna.

1.4 EQUIPMENT SPECIFICATIONS.

Frequency range	2.0 to 30.0 mc.
Mode	Single sideband (USB, LSB, or twin sideband), AM.
Frequency stability	1 part in 10^6 per month or better.
Receiver sensitivity	1 microvolt for 10-db signal-plus-noise to noise ratio on SSB. 2 microvolts for 10-db signal-plus-noise to noise ratio on AM.
Receiver selectivity	350 cps to 3000 cps passband above and below the carrier.
Receiver audio distortion	Less than 10 percent.
R-f input impedance	50 ohms unbalanced.
Audio outputs (normal)	LSB line +14 to -34 dbm into 60 ohms balanced (adjusted by attenuator).
	USB line +14 to -34 dbm into 600 ohms balanced (adjusted by attenuator). Headphone or speaker monitor - LSB, USB or combined.
	Speaker output - 2 watts into 4 or 600 ohms.
Power requirements	115/230 volts a-c, single phase, 50/60 cps, 220 watts maximum.
Weight	235 pounds (with shockmounts).

1.5 UNIT DESCRIPTION.

1.5.1 FREQUENCY GENERATOR 786E-1.

H-F Communications Receiver 50E-7B uses a Frequency Generator 786E-1 unit consisting of a frequency generator chassis and the following plug-in modules: r-f tuner, frequency divider, stabilized master oscillator, sidestep oscillator, and reference oscillator.

The reference oscillator module provides the basic reference frequencies of 100 kc and 2.4 mc for the receiver. The reference oscillator signal is generated by a 3-mc crystal-controlled temperature stabilized oscillator.

The stabilized master oscillator is mechanically and electronically tuned through the frequency range of 2.0 to 4.0 mc in 125-cps steps. Frequency stability is determined by the reference oscillator frequency standard.

The 2.0- to 30.0-mc frequency range of the 786E-1 is covered in the following four bands: 2.0 to 3.7 mc, 3.7 to 7.7 mc, 7.7 to 15.7 mc, and 15.7 to 30.0 mc. The 786E-1 performs a single conversion on the 2.0- to 3.7-mc band and a double conversion on the 3.7- to 30.0-mc bands. The 786E-1 supplies 300-kc i-f frequency to I-F Translator 786K-1 for audio detection.

BNC connectors are supplied for antenna, intermediate frequencies, and 100-kc reference signals. All power and control connections are made through two 16-pin quick-disconnect connectors.

1.5.2 I-F TRANSLATOR 786K-1.

I-F Translator 786K-1 translates the 300-kc i-f frequency received from Frequency Generator 786E-1 to usable audio, CW, or FSK outputs. It includes controls for selection of upper sideband, lower sideband, both sidebands, or AM outputs. A tunable beat frequency oscillator is included for aid in reception of CW or RTTY signals. The 786K-1 consists of a main chassis, subassemblies, and four plug-in modules which are as follows:

AM i-f/a-f module (AM reception)
USB i-f/a-f module (USB reception)
LSB i-f/a-f module (LSB reception)
Carrier generator module (SSB detection)

All input and output connections are made through two quick-disconnect 16-pin connectors on the rear of the unit, except for the 300-kc i-f and 100-kc reference signal inputs which the BNC coaxial connectors utilize.

1.5.3 LOW-VOLTAGE POWER SUPPLY 429B-1.

Low-Voltage Power Supply 429B-1 is used in H-F Communications Receiver 50E-7B to supply all operating voltages for Frequency Generator 786E-1 and I-F Translator 786K-1. All of the voltage rectifiers are semiconductor diodes and operate from a common power transformer. The 429B-1 is operated from a 115-volt, 50- to 60-cps, single-phase primary power source. With the proper connections it may be operated from a 230-volt a-c source. The following voltages are supplied:

+250 volts d-c filtered.
+130 volts d-c filtered,
+28 volts d-c unfiltered,
+28 volts d-c partly filtered,
+28 volts d-c regulated,
12.6 volts a-c center tapped, and
-90 volts d-c filtered

1.5.4 BLOWER 199M-1.

Blower 199M-1 supplies filtered cooling air to all units through a center air duct. It is a centrifugal blower capable of delivering 68 cfm of free air. The blower is driven by a direct-coupled, 115-volt, single-phase induction motor. The air input is through an air filter located on the front of the blower. The primary power circuit is applied to H-F Communications Receiver 50E-7B through the ON-OFF switch on the front panel of I-F Translator 786K-1 and the interlock relay of Blower 199M-1.

1.5.5 SYSTEM RACK AND JUNCTION BOX.

All units of H-F Communications Receiver 50E-7B are mounted on an open-type rack with power and control interconnections being made through Junction Box 153H-3. The rack is constructed of 6-inch heavy aluminum channel with steel-angle stock across the bottom to which a base plate is attached. The side channels of the rack are drilled for mounting standard 19-inch open-type chassis. The rack is 70-1/2 inches high and 20-1/2 inches wide overall.

Junction Box 153H-3 contains the thermal relay input protector, main power fuse holders, and the terminal blocks of the interconnection cables. All unit interconnections, except coaxial cables, are made by bus wire jumpers on the terminal blocks. The rack air duct contains valved ports which mate with the cooling air holes in the back of the unit chassis. If a chassis is swung out for inspection during operation, the valve closes and prevents loss of cooling air pressure.

The thermal relay receiver protective unit is used to provide the receiver with protection from excessive currents entering the receiver antenna input jack (J11 of Frequency Generator 786E-1). Excessive currents are those currents of 100 milliamperes or greater. The main components of this unit are a coaxial relay, thermal relay, indicator lamp, and a reset button. The reset button, fuse holders, and indicator lamp are accessible from the front panel of the Junction Box.

SECTION II
INSTALLATION

2.1 INSTALLATION.

H-F Communications Receiver 50E-7B is shipped completely assembled with all units mounted. A minimum of 14-1/2 inches is required at the front of the rack for swinging out units. See figure 7-1 for outline and mounting dimensions. The 50E-7B is mounted in place by securing its base and the top or back of the rack.

2.2 PRIMARY POWER CONNECTIONS.

H-F Communications Receiver 50E-7B is shipped wired for 115-volt, 50- to 60-cps, single-phase operation. For primary power connections, see figures 7-2 and 7-4. The 50E-7B receiver may be operated from a 230-volt, 50- to 60-cps, single-phase source by reconnecting the primaries of the 429B-1 power supply transformer, and the interlock relay in Blower 199M-1. See TD-115 and TD-523 for instructions. Also, see figure 7-2 of this SP.

2.3 EXTERNAL CONNECTIONS.

External connections to H-F Communications Receiver 50E-7B are shown in figure 7-3.

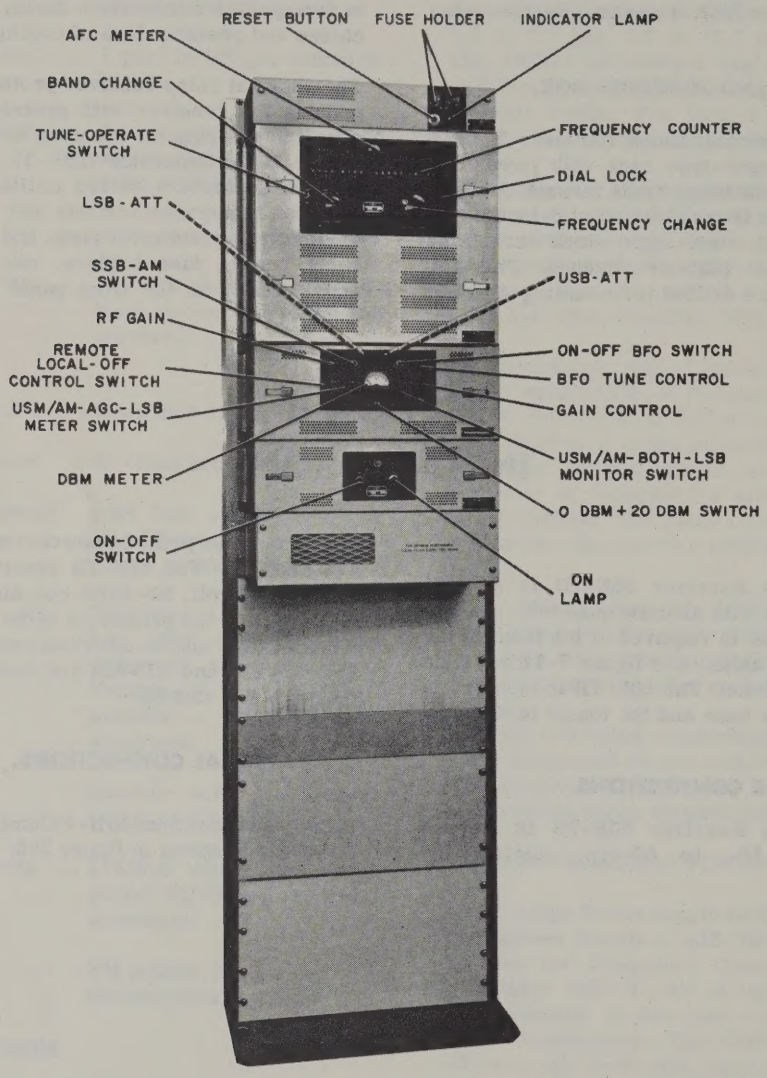


Figure 3-1. H-F Communications Receiver 50E-7B, Operating Controls

SECTION III
OPERATION

3.1 OPERATING CONTROLS.

3.1.1 GENERAL.

Figure 3-1 identifies all operating controls, switches, meters, and indicators. The following paragraphs list and describe these operating controls, switches, meters and indicators according to the major unit upon which they are located.

3.1.2 FREQUENCY GENERATOR 786E-1.

TUNE-OPERATE switch . . . . . Disables the smo feedback loop during tuning to prevent its locking on a spurious frequency.

BAND CHANGE switch . . . . . Selects band of operation for Frequency Generator 786E-1.

FREQUENCY CHANGE control . . . . . Selects frequency of operation. Selected frequency indicated on counter dials under lighted band indicator lamp.

DIAL LOCK . . . . . Locks frequency counter dials and tuning controls at selected frequency.

Band indicator lamps . . Lights over dial of frequency band selected.

AFC meter . . . . . Indicates the corrective signal applied to the master oscillator from the stabilization circuit of the stabilized master oscillator.

3.1.3 LOW-VOLTAGE POWER SUPPLY 429B-1.

ON-OFF switch . . . . Controls primary power to 429B-1 power supply.

Indicator lamp . . . . . Lights when primary power is applied to transformer primary.

3.1.4 I-F TRANSLATOR 786K-1.

R-F GAIN control . . . Controls r-f gain and i-f gain of receiver when CONTROL switch is in LOCAL position.

CONTROL switch . . . Turns off primary power in OFF position. Normal operating position is LOCAL. The REMOTE position is used when a remote receiver r-f gain control and level meter are used.

METER switch and meter . . . . . The METER switch selects the function which is indicated on the meter. In LSB, the meter indicates the LSB audio level placed upon the output lines. In AGC, the meter indicates the agc voltage as an indication of received signal strength. In USB/AM, the meter indicates the USB or AM audio level placed upon the output lines.

LSB ATT control. . . . Adjusts level of LSB audio signal placed upon output lines (screwdriver adjustment behind control panel).

USB ATT control. . . . Adjusts level of USB or AM audio signal placed upon output lines (screwdriver adjustment behind control panel).

BFO ON-OFF switch . . Turns tunable beat frequency oscillator ON or OFF.

BFO TUNE control. . . Tunes bfo to vary CW or FSK audio output frequency.

SSB-AM switch . . . . Selects desired mode of reception.

0 DBM-+20 DBM switch . . . . . Selects desired range of meter for indication of audio level on balanced output lines.

MONITOR controls . . . Sideband selector switch selects USB/AM, LSB or BOTH sidebands to be monitored on local headphones or speaker. GAIN control adjusts level of local monitor output. PHONES jacks accepts standard headphone plug for local monitoring.

3.2 OPERATING PROCEDURES.

3.2.1 PRELIMINARY SETTINGS.

Before turning on equipment, perform the following preliminary settings.

Low-Voltage Power Supply 429B-1	Turn ON-OFF switch to OFF.
I-F Translator 786K-1 .	USB ATT to maximum counterclockwise position.
	LSB ATT to maximum counterclockwise position.
	SSB-AM switch to desired mode.
	BFO switch to OFF position.
	CONTROL switch to OFF position.
	METER switch to AGC position.
	MONITOR GAIN control to maximum counterclockwise position.

3.2.2 TURNING ON EQUIPMENT.

Apply power to the equipment by turning ON-OFF switch on the control panel of Low-Voltage Power Supply 429B-1 to ON. Turn the CONTROL switch on front panel of I-F Translator 786K-1 to LOCAL. This applies power to the receiver. The indicator lamp on the 429B-1 will light when power is applied.

3.2.3 TUNING PROCEDURE.

Use the following tuning procedure whenever the 50E-7B is set to a new operating frequency.

a. Set BAND CHANGE switch on Frequency Generator 786E-1 to the desired frequency band. The band indicator lamp will light over the selected frequency counter. The 50E-7B frequency bands are as follows:

Band 1	2.0 to 3.7 mc
Band 2	3.7 to 7.7 mc
Band 3	7.7 to 15.7 mc
Band 4	15.7 to 30.0 mc

b. Release DIAL LOCK on Frequency-Generator 786E-1. Set the desired operating frequency on the lighted frequency counter using the FREQUENCY CHANGE control. When selecting a frequency on BAND 3 or BAND 4 which is not on the 7.7- to 15.7-mc or the 15.7- to 30.0-mc band frequency counters, set frequency counter to the next lower frequency on the counter, and set BAND CHANGE switch to ADD 1 KC, ADD 2 KC, or ADD 3 KC. When the desired operating frequency is on the frequency counter dial, set BAND CHANGE switch to ADD 0 KC. Example: To select an operating frequency of 23.699 mc, set the 15.7- to 30.0-mc frequency counter dial to 23.696 mc using the FREQUENCY CHANGE control, and set the BAND CHANGE switch to BAND 4 ADD 3 KC.

NOTE

When setting up a frequency on any band, make certain the white index line on the last dial of the 15.7- to 30.0-mc frequency counter is centered in the window. Band 1 frequencies will lock on 500-cps increments if the last counter dial is in an intermediate position.

c. Reset DIAL LOCK, and momentarily depress TUNE-OPERATE switch on Frequency Generator 786E-1 to TUNE. This prevents the stabilized master oscillator from locking on spurious signals. The AFC meter shows the amount of correction being supplied to the master oscillator from the stabilization circuits and should not be expected to read zero unless the master oscillator is exactly on frequency.

d. When receiving a signal, the RF GAIN control of I-F Translator 786K-1 controls the r-f gain and i-f gain of the receiver when the CONTROL switch is in LOCAL position. The METER switch selects the function which is indicated on the meter. In LSB position, the meter indicates the LSB audio level placed upon the output lines and the LSB ATT control adjusts the level of the LSB audio signal placed upon the output lines. In USB position, the meter indicates the USB or AM audio level placed upon the output lines, and the USB ATT control adjusts the level of the USB or AM audio signal placed upon output lines.

e. The USB/AM, LSB or both channels may be monitored by headphones plugged into the PHONES jack by selecting the desired output with the MONITOR switch and adjusting the GAIN control on the front panel for the desired output level.

3.2.4 TURNING OFF EQUIPMENT.

Place the CONTROL switch on I-F Translator 786K-1 panel to OFF. This removes all voltages from the individual unit chassis. The ON-OFF switch of the 429B-1 may be left in the ON position at all times under normal usage.

3.3 OPERATOR CHECKS.

3.3.1 METER READINGS.

The METER switch of I-F Translator 786K-1 selects the function which is indicated on the meter. In LSB position, the meter indicates the LSB audio level placed upon the output lines. In AGC position, the meter indicates the agc voltage as an indication of

received signal strength. In USB/AM position, the meter indicates the USB or AM audio level placed upon the output lines.

3.3.2 STABILIZED MASTER OSCILLATOR CHECK.

The AFC meter on the front panel of Frequency Generator 786E-1 provides a visual means of checking for stabilizing loop correction. The deflection of the meter is proportional to the frequency correction of the master oscillator by the smo stabilizing loop.

a. For models B and C SMO, use the following AFC meter limits for indication of faulty operation.

BAND 1 FREQUENCY	MAXIMUM AFC
up to 2.0 mc	90 ua
2.0 to 2.5 mc	80 ua
2.5 to 3.0 mc	70 ua
3.0 to 3.7 mc	50 ua

NOTE

Refer to band 1 dial reading for AFC meter reading. This applies, no matter which band the radio set may be operating on.

Excessive meter readings indicate either the smo is not locking on the reference signal, the pull-in of the stabilizing loop is near its maximum range, or the smo needs alignment or repair.

b. Depress TUNE-OPERATE switch on the 786E-1 to TUNE, and check that the AFC meter reading goes to zero. When the TUNE-OPERATE switch is released to OPERATE, the AFC meter reading should return to the original reading.

c. Switch BAND CHANGE switch from BAND 3 ADD 0 KC to BAND 3 ADD 1 KC, and check that the AFC meter reading is deflected about one division. A deflection of about one-half a division should be observed when switching between ADD 0 KC, ADD 1 KC, ADD 2KC, and ADD 3 KC on BAND 4. The amount of deflection is nominal, but the perception of the deflection is an indication of a change in the master oscillator frequency.

SECTION IV
PRINCIPLES OF OPERATION

4.1 GENERAL.

H-F Communications Receiver 50E-7B is a manually operated, high stability, SSB or AM receiver for operation in the 2.0- to 30.0-mc high-frequency range. The SSB or AM r-f signals go through single conversion on band 1 and double conversion on bands 2, 3, and 4. This output feeds into an i-f frequency where detection of the audio occurs.

4.2 BLOCK DIAGRAM.

4.2.1 GENERAL.

Figure 4-1 is a general block diagram of the receiver. The following discussion of the block diagram is divided into frequency conversion, demodulation, and power supply functions.

4.2.2 FREQUENCY CONVERSION.

Frequency Generator 786E-1 amplifies the r-f signal from the antenna and translates it to a 300-kc i-f signal. The 2-to 30-mc frequency range of the receiver is covered in four bands: 2 to 3.7 mc, 3.7 to 7.7 mc, 7.7 to 15.7 mc, and 15.7 to 30 mc. Single conversion is used on the 2- to 3.7-mc band, and double conversion is used on the remaining bands. A combination of mechanical and electrical tuning provides tuning to any one-kc frequency increment in the range of 2 to 30 mc. A self-contained 100-kc reference oscillator module with a stability of one part in 10^6 is used to produce the necessary frequency injection signals. An agc voltage, which is generated in the 786K-1 unit is used to control the gain of the r-f amplifier circuits of the 786E-1 unit.

4.2.3 DEMODULATION.

The 300-kc i-f signal from the 786E-1 unit is demodulated by I-F Translator 786K-1. An accurate source of 300.0-kc signal is produced from the 100-kc standard by the carrier generator. This signal serves as the demodulating carrier in the product detectors of the two SSB i-f amplifiers. Each i-f amplifier has a transistor audio amplifier to allow independent output from each i-f unit, USB, AM, or LSB.

AM signals are detected in the AM i-f amplifier by a standard diode detector. FSK and CW operation are enhanced by the incorporation of a variable beat frequency oscillator (bfo).

When the bfo is turned on, the 100-kc input signal to the carrier generator is electronically removed and replaced by the variable 300-kc output signal of the bfo. The output of the bfo is variable from approximately 299.550 kc to 301.550 kc. This signal passes through the carrier generator module and is applied to the SSB i-f amplifier product detectors for demodulation of the incoming signal.

The audio signal on either sideband or AM may be monitored with the front panel dbm meter on I-F Translator 786K-1. Provisions are also incorporated

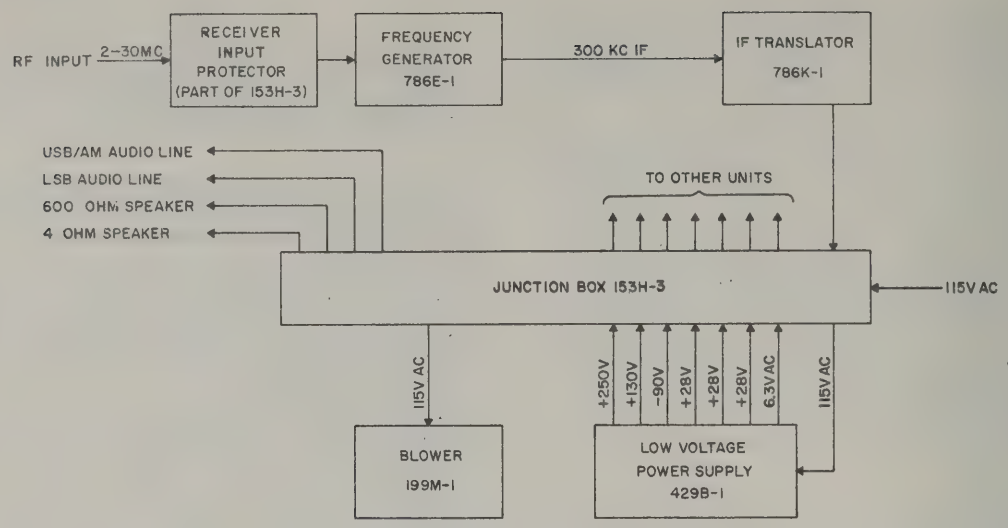


Figure 4-1. H-F Communications Receiver 50E-7B, Block Diagram

for monitoring of the signals with local headphones or speaker. AM is received on the USB channel.

4.2.4 POWER SUPPLY.

Low-Voltage Power Supply 429B-1 is used in H-F Communications Receiver 50E-7B and supplies voltages to Frequency Generator 786E-1 and I-F Translator 786K-1. All voltages rectifiers in the 429B-1 use semiconductor diodes and operate from a common power transformer. Zener diode regulation is furnished on the 28-volt d-c supply. The 429B-1 is operated from a 115-volt, 60-cps, single-phase primary power source. With the proper connections the 429B-1 also may be operated from a 230-volt a-c source.

4.3 CIRCUIT DESCRIPTION.

Detailed circuit descriptions are presented in the following unit instructions which are included as part of this manual.

a. TD-113, Frequency Generator 786E-1.
b. TD-115, Low-Voltage Power Supply 429B-1.
c. TD-497, I-F Translator 786K-1.
d. TD-523, Blower 199M-1.
e. TD-496, Junction Box 153H-3.

SECTION V
MAINTENANCE

5.1 GENERAL.

This section contains trouble-isolation procedures and system adjustments for H-F Communications Receiver 50E-7B.

NOTE

Do not disturb alignment and frequency trimmer adjustments during routine inspections or trouble-shooting and system adjustments procedures. Make no alignment adjustments except after parts replacement or general overhaul. Make no frequency standard adjustments except during calibration or netting procedures.

Before performing maintenance on this equipment, personnel should become familiar with physical make-up of the equipment, installation, operating procedures, and principles of operation. Unit instructions in this manual contain maintenance instructions for each major unit.

5.2 TEST EQUIPMENT AND SPECIAL TOOLS REQUIRED.

Table 5-1 lists the test equipment and special tools required for maintenance of H-F Communications Receiver 50E-7B. Special extension cables and an extension board for module servicing are included in the pendant cable service kit (not supplied). The contents of this kit are listed in table 5-2 and illustrated

in figure 5-1. Figures 5-2 and 5-3 show extension cables, extension board, and module tray in use. Figure 5-4 shows a signal tracing diagram for H-F Communications Receiver 50E-7B.

TABLE 5-1. TEST EQUIPMENT AND SPECIAL TOOLS REQUIRED.

QUANTITY	ITEM	TYPE OF DESCRIPTION
1	Vacuum-tube voltmeter	Hewlett-Packard 410B
1	A-c vacuum-tube voltmeter	Ballantine 310A
1	Multimeter	Triplett 630
1	Communications receiver	Collins 51J-4
1	R-f signal generator	Measurements Corp. 82
1	Distortion analyzer	Hewlett-Packard 330D
1	Speaker	2-watt, 4 or 600 ohms
1	Frequency counter	Hewlett-Packard 524A
1	Headphones	High impedance
1	Output meter	Daven OP-182

TABLE 5-2. CONTENTS OF PENDANT CABLE SERVICE KIT

FIGURE 5-1 ITEM	DESCRIPTION
A	Module tray and cable storage box
B	Extension cable for sidestep oscillator and isolation amplifier
C	Extension cable for sidestep oscillator and frequency divider modules
D	Extension cable for i-f/a-f amplifier and r-f tuner modules
E	Extension cable for r-f tuner and smo modules
F	Extension cable for carrier generator module
G	Extension board for smo module subassemblies
H	Reference oscillator module alignment cover

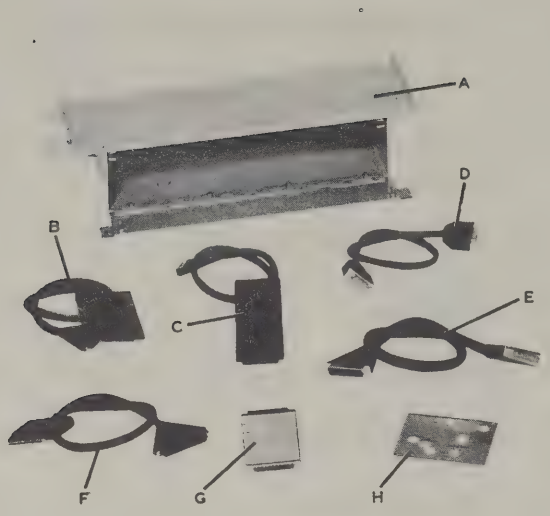


Figure 5-1. Pendant Cable Service Kit

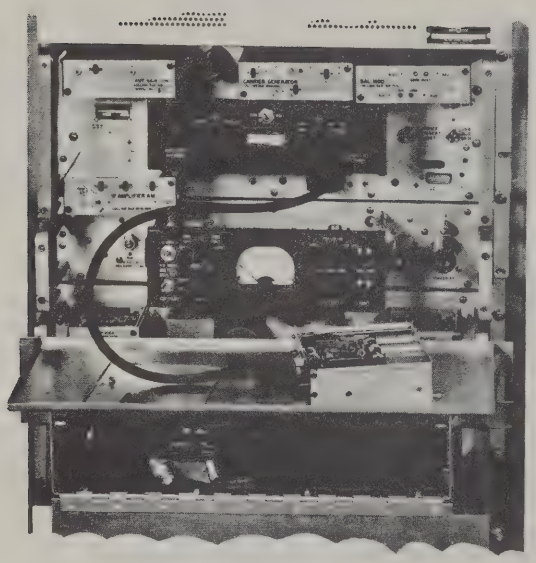


Figure 5-2. Typical Application of Module Tray and Extension Cable

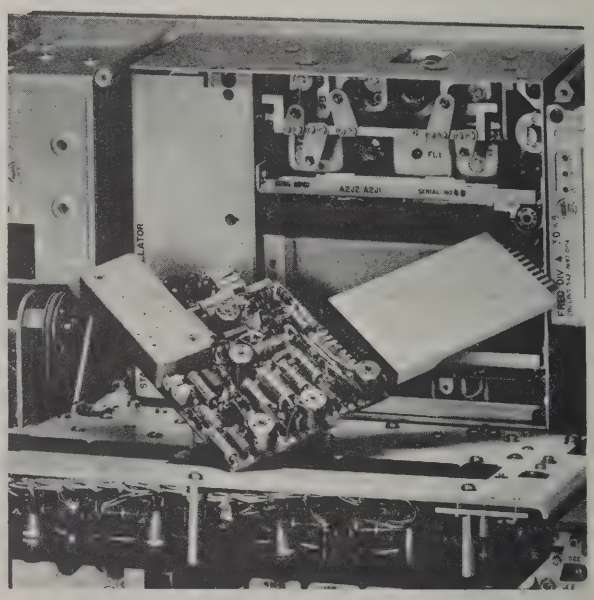


Figure 5-3. Typical Application of SMO Subassembly Extension Board

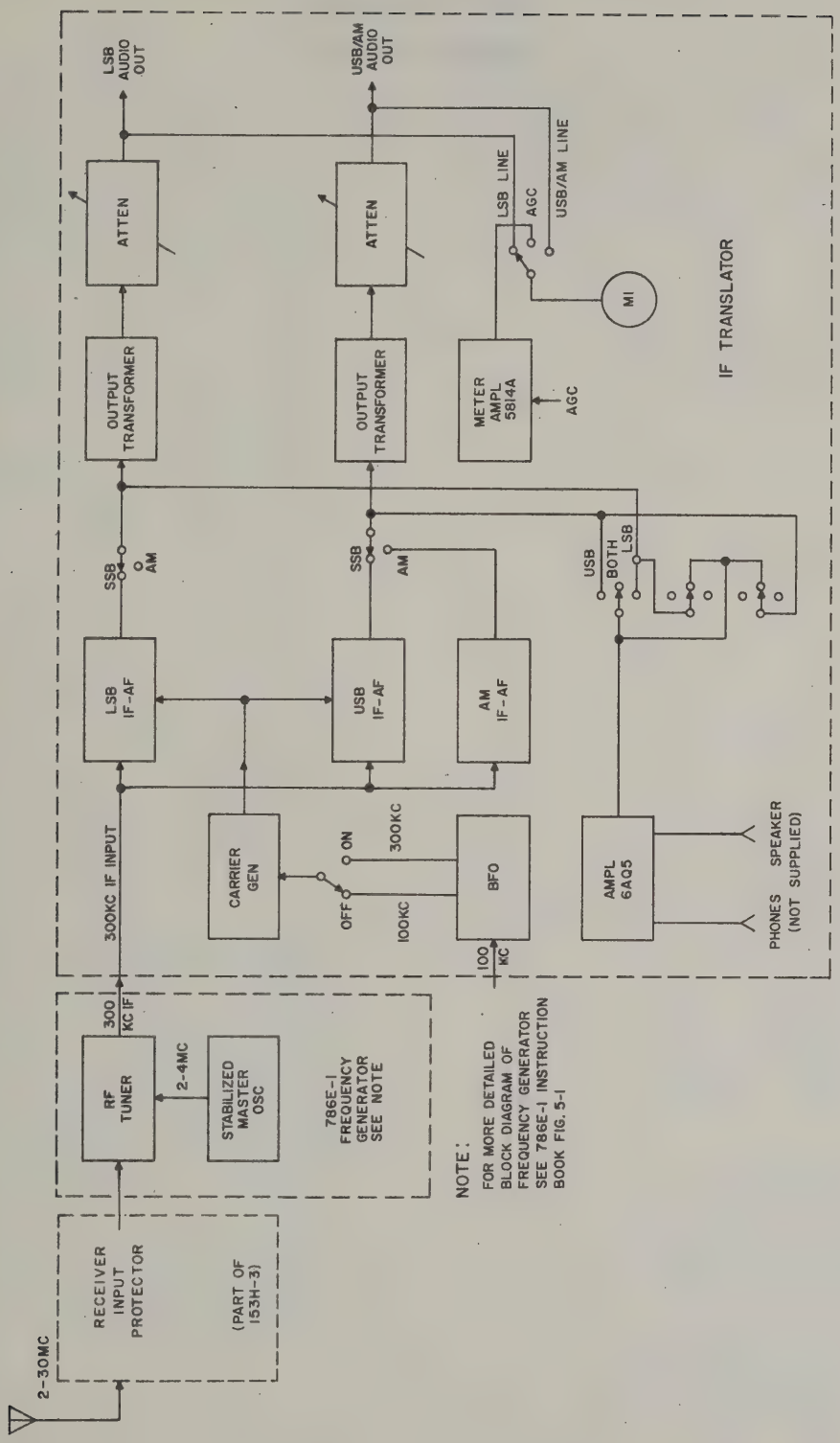


Figure 5-4. H-F Communications Receiver 50E-7B, Signal Tracing Diagram

SECTION VI
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	H-F COMMUNICATIONS RECEIVER 50E-7B	522-2944-00
	COOLER, AIR, ELECTRONIC EQUIPMENT 199M-1	522-2444-00
B1001	BLOWER ASSEMBLY: centrifugal, inverted, direct coupled ac, 40 w at 115 volts ac, 60 cps at free air, 3000 rpm min, 115 volts ac rms, 50-60 cps single phase, 0.370 amp, continuous duty cycle, double shielded ball bearing, stainless steel shaft, dia cast aluminum motor case	009-1360-00
C1001	CAPACITOR, FIXED, PAPER DIELECTRIC: tubular w/ wire leads; 400 volts dc; 470,000 uuf, ±20%; uninsulated metal case, hermetically sealed; 0.750 in dia by 2-1/8 in. lg; 1-R schematic	931-4559-00
C1002	CAPACITOR, FIXED, PAPER DIELECTRIC: 600 volts dc, 1.0 uuf, ±10%; hermetically sealed metal case; 7/8 in. by 1-3/4 in. by 2 in.; uninsulated	961-4417-00
E1001	TERMINAL STUD: brass terminal, glass filled diallyl phthalate insulation; brass, cadmium plated, 4-40 thd mtg stud; 1/4 in. hex by 3/4 in. lg overall	306-0977-00
E1002	TERMINAL STUD: Same as E1001	306-0977-00
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: 16 female contacts, 5 amp at 600 volts dc	372-1265-00
K1001	RELAY, ARMATURE: 1A contact arrangement; 15 amp at 120 volts ac, resistive; 120, 240 volts ac nom coil voltage; 700, 1400 ohms coil resistance, 60 cps; continuous duty cycle	970-2161-00
H1001	WASHER, LOCK: CRES; split helical ring; 0.115 in. ID, 0.253 in. OD, 0.031 in. thk	310-0279-00
H1002	WASHER, LOCK: CRES; split helical ring; 0.141 in. ID, 0.263 in. OD, 0.031 in. thk	310-0282-00
H1003	WASHER, FLAT: CRES; 0.147 in. ID, 3/8 in. OD, 0.031 in. thk	310-6360-00
H1004	NUT, PLAIN, HEXAGON: stainless steel; 6-32 thd 0.312 in. hex by 0.109 in. thk	313-0002-00
H1005	NUT, PLAIN, HEXAGON: CRES; 4-40 NC-2, 3/16 in. w across flats, 1/16 in. thk	313-0132-00
H1006	SCREW, MACHINE: CRES; Phillips flathead; 8-32 NC-2A thd, 1/4 in. lg	342-0076-00
H1007	SCREW, MACHINE: CRES; Phillips flathead; 4-40 NC-2A thd; 1/4 in. lg	342-0044-00
H1008	SCREW, MACHINE: stainless steel, Phillips flathead, 6-32 NC-2A thd, 1 in. lg	352-0069-00
H1009	SCREW, MACHINE: CRES; Phillips panhead; 2-56 NC-2A, 1/8 in. lg	343-0122-00
H1010	SCREW, MACHINE: stainless steel; panhead; 4-40 NC-2A thd; 5/16 in. lg	343-0134-00
H1011	SCREW, MACHINE: steel; Phillips recessed flathead, 6-32 NC-2A thd, 5/16 in. lg	342-0061-00
MP1001	MOUNT, RESILIENT: synthetic rubber	200-0629-00
MP1002 thru MP1004	MOUNT, RESILIENT: same as MP1001	200-0629-00
	INSTALLATION KIT, CABLE	553-2727-00
W1	CABLE ASSEMBLY, RADIO FREQUENCY: coaxial, 19 strands of 0.0066 in. copper wire, 50.0 ohms impedance, 5000 volts, outer conductor single braid, one rd male contact ea end	544-7397-00
W2	CABLE ASSEMBLY, RADIO FREQUENCY: same as W1	544-7397-00
W3	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 16 conductors, one 16-male contact connector plug, one end; one 20-pin terminal board, 26 in. excluding termination	547-3743-003
	TERMINAL BOARD: wood filled cyanamide; 7/8 in. by 6-3/4 in. overall; incl 2 inserts and 20 solder lug terminals	543-2000-003
	CONNECTOR, PLUG: 16 male contacts, 5 amp at 600 volts dc	372-1274-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
W4	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 16 conductors, one 16-male contact connector plug one end, one 20-pin terminal board, 26 in. lg, excluding termination	547-3742-003
	TERMINAL BOARD: wood-filled cyanamide; 7/8 by 6-3/4 in. overall; incl. 2 inserts and 20 solder lug terminals	543-2000-003
	CONNECTOR, PLUG: 16 male contacts, 5 amps;	372-1270-00
W5	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 16 conductors, one 16-male contact connector plug, one end; one 20-pin terminal board; 35 in. excluding termination	547-3744-003
	TERMINAL BOARD: wood-filled cyanamide; 7/8 in. by 6-3/4 in. overall; incl 2 inserts and 20 solder lug terminals	543-2000-003
	CONNECTOR, PLUG: 16 male contacts, 5 amp at 600 volts dc	372-1276-00
W6	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 16 conductors, one 16-male contact connector plug one end; one 20-pin terminal board; 35 in. lg, excluding termination	547-3740-003
	TERMINAL BOARD: wood-filled cyanamide; 7/8 in. by 6-3/4 in. overall; incl. 2 inserts and 20 solder lug terminals	543-2000-003
	CONNECTOR, PLUG: 16 male contacts; 5 amp at 600 volts dc	372-1272-00
W7	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: same as W5	547-3744-003
W8	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: same as W6	547-3740-003
W9	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: 16 conductors, one 16-male contact connector plug one end, one 20-pin terminal board; 43 in. lg excluding termination	547-3741-003
	TERMINAL BOARD: wood-filled cyanamide; 7/8 in. by 6-3/4 in. overall; incl. 2 inserts and solder lug terminals	543-2000-003
	CONNECTOR, PLUG: 16 male contacts, 5 amp at 600 volts dc	372-1278-00
W10	CABLE ASSEMBLY: no. RG 58 C/U cable terminated each end w/a male connector	546-3425-00
	RACK ASSEMBLY KIT	553-2776-00
H1	WASHER, LOCK: CRES; split helical ring; 3/8 in. ID, 0.688 in. OD, 0.094 in. thk	310-0292-00
H2	SCREW, MACHINE: stainless steel; standard trimmed hexagon head; 3/8-16UNC-2A thd, 5/8 in. lg	325-0124-00
H3	WASHER, LOCK: stainless steel; 0.255 in. ID, 0.493 in. OD, 0.062 in. thk	310-0288-00
H4	NUT, PLAIN, HEXAGON: CRES; 1/4-20NC-2 thd; 7/16 in. hex by 3/16 in. h	313-0032-00
H5	SCREW, MACHINE: stainless steel; Phillips recessed flathead; 1/4-20 UNC-2A, 3/4 in. lg	342-0260-00
H6	CHANNEL, RIGHT HAND: aluminum; chromate dip finish; 1.093 in. by 6.009 in. by 70.125 in. over-all dim	544-9014-004
H7	CHANNEL, LEFT HAND: aluminum; chromate dip finish; 1.093 in. by 6.009 in. by 70.125 in, over-all dim	544-9015-004
H8	BASE, RACK: steel; 4.000 in. by 16.750 in. by 20.500 in. over-all dim	553-2730-004
H9	BRACKET, ANGLE: steel; 0.187 in. by 1.500 in. by 20.250 in. over-all dim	544-9013-003
H10	ANGLE BASE, CHANNEL: steel; 1.187 in. by 3.000 in. by 5.250 in. over-all dim	545-3048-002
H11	ANGLE, TOP BRACE: steel; 1.875 in. by 3.750 in. by 19.750 in. over-all dim	545-3049-002
	AIR DUCT KIT	549-5505-00
H1	SCREW MACHINE: steel, self-tapping, Phillips stove truss head, screw size 6, 5/16 in. lg	330-1183-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
H2	SCREW, MACHINE: CRES; panhead, 0.373 in. dia 0.110 in. h; 10-32 NC-2A thd, 1/2 in. lg	343-0228-00
H3	SPRING, HELICAL, EXTENSION: CRES; close wound, 34 turns; 0.221 in. ID, 0.309 in. OD, 0.356 in. lg compressed	542-3022-002
MP1	DUCT ASSEMBLY, AIR, SHORT: c/o air duct, wire, staked actuator assembly and duct spring; 2-7/8 in. dia by 1-15/16 in. lg approx overall	542-3007-003
MP2	DUCT ASSEMBLY, AIR, LONG: c/o air duct, wire, staked actuator assembly and duct spring; 2-7/8 in. dia 2-3/4 in. long approx overall	542-3008-003
MP3	DUCT, ASSEMBLY, AIR: aluminum; 2.000 in. by 7.375 in. by 32.500 in. overall dim; incl 1 bracket and 4 nuts	549-5508-003
MP4	ACTUATOR AND DISC ASSEMBLY: aluminum; 1.656 in. dia by 1.937 in. lg	542-3020-002
MP5	ACTUATOR AND DISC ASSEMBLY: aluminum; 1.656 in. dia by 2.749 in. lg	542-3021-00
MP6	DUCT, AIR, REAR: aluminum; 2.000 in. by 7.375 in. by 32.500 in. over-all dim; incl 2 nuts	549-5514-004
MP7	SUPPORT, DUCT: steel; 1.250 in. by 2.000 in. by 3.437 in. over-all dim	553-2461-002
MP8	DUCT, TRANSITION: aluminum; chromate dip finish; 2.171 in. by 3.031 in. by 3.046 in. over-all dim	547-3750-004
MP9	COVER, DUCT: steel; 0.625 in. by 2.015 in. by 8.015 in. over-all dim	541-8253-003

SECTION VII
ILLUSTRATIONS

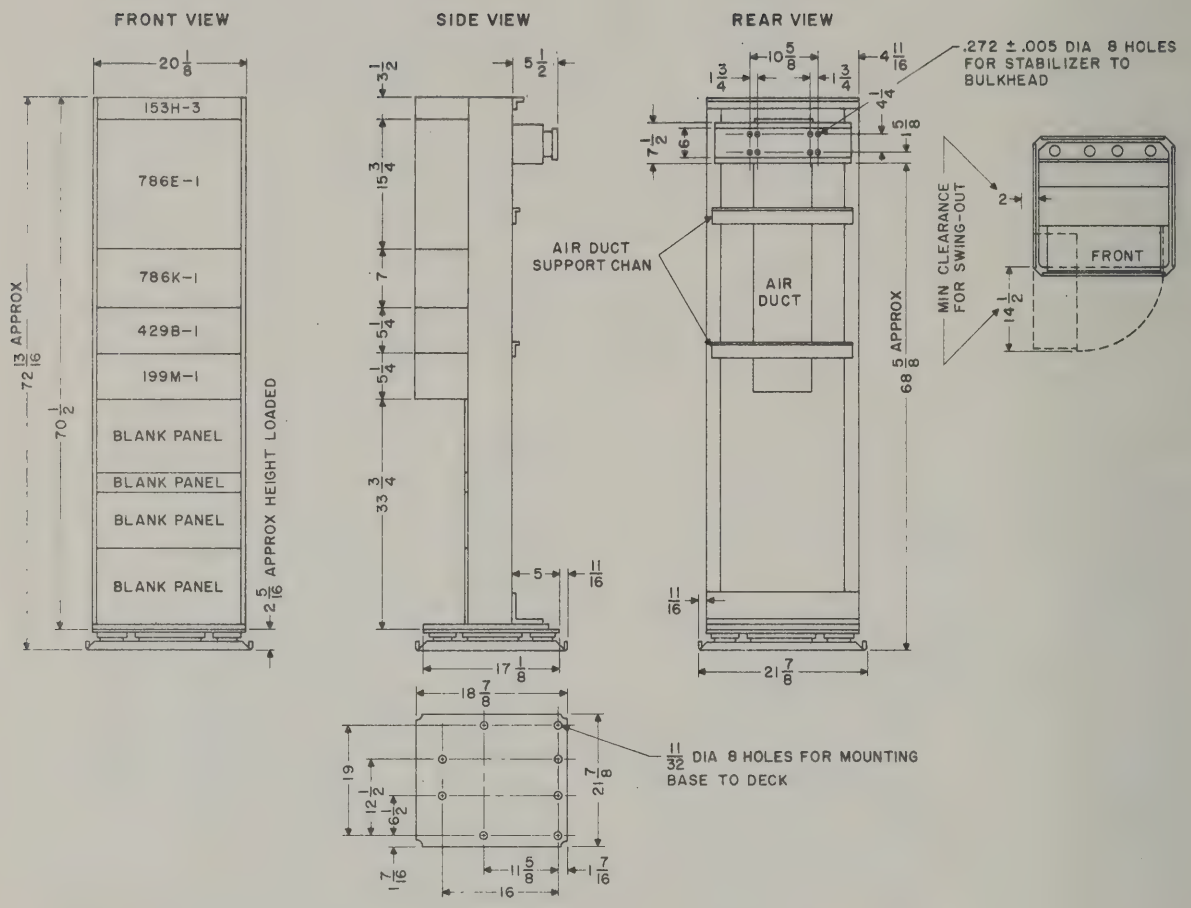


Figure 7-1. H-F Communications Receiver 50E-7B, Outline and Mounting Dimensions

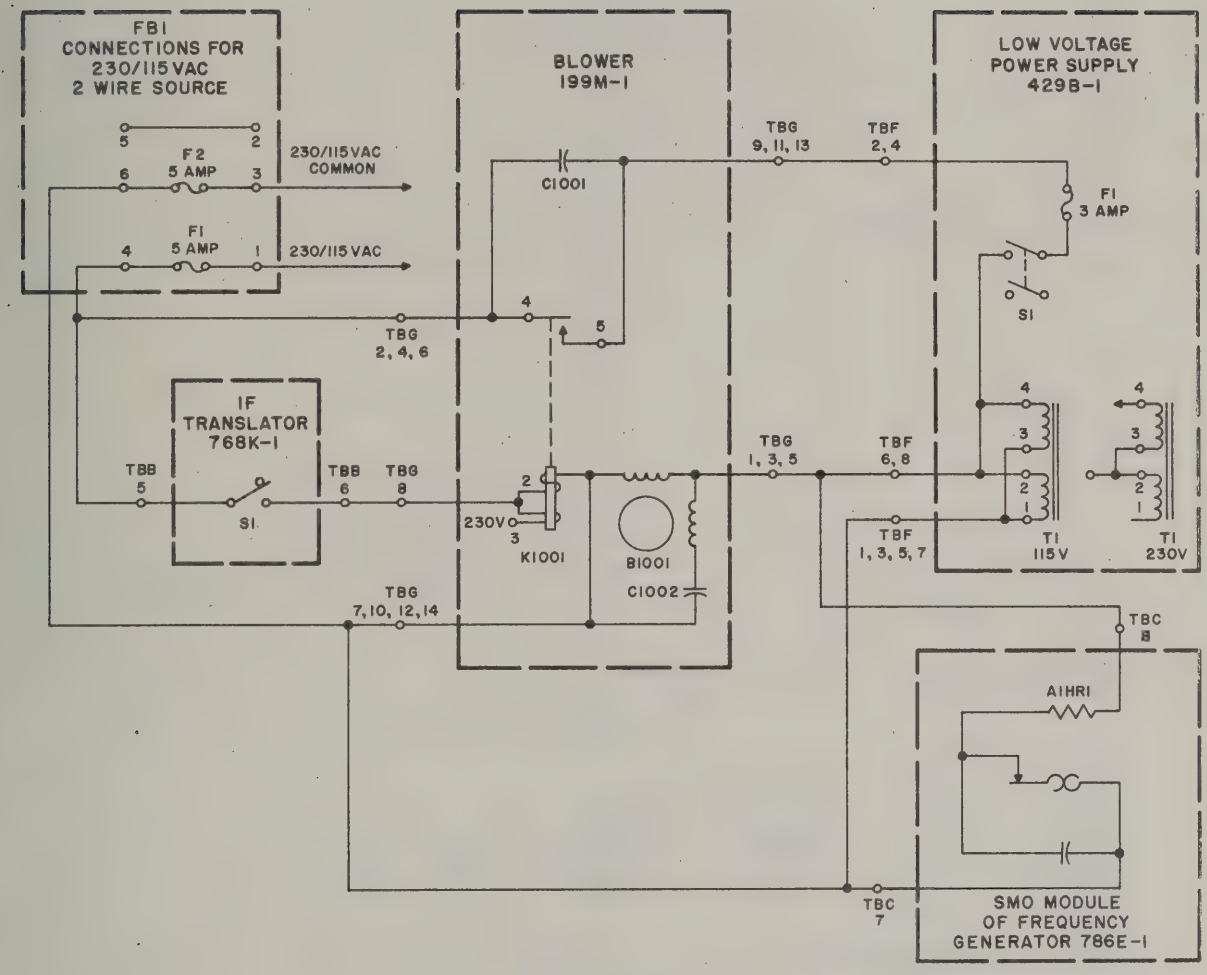


Figure 7-2. H-F Communications Receiver 50E-7B, Primary Power Distribution

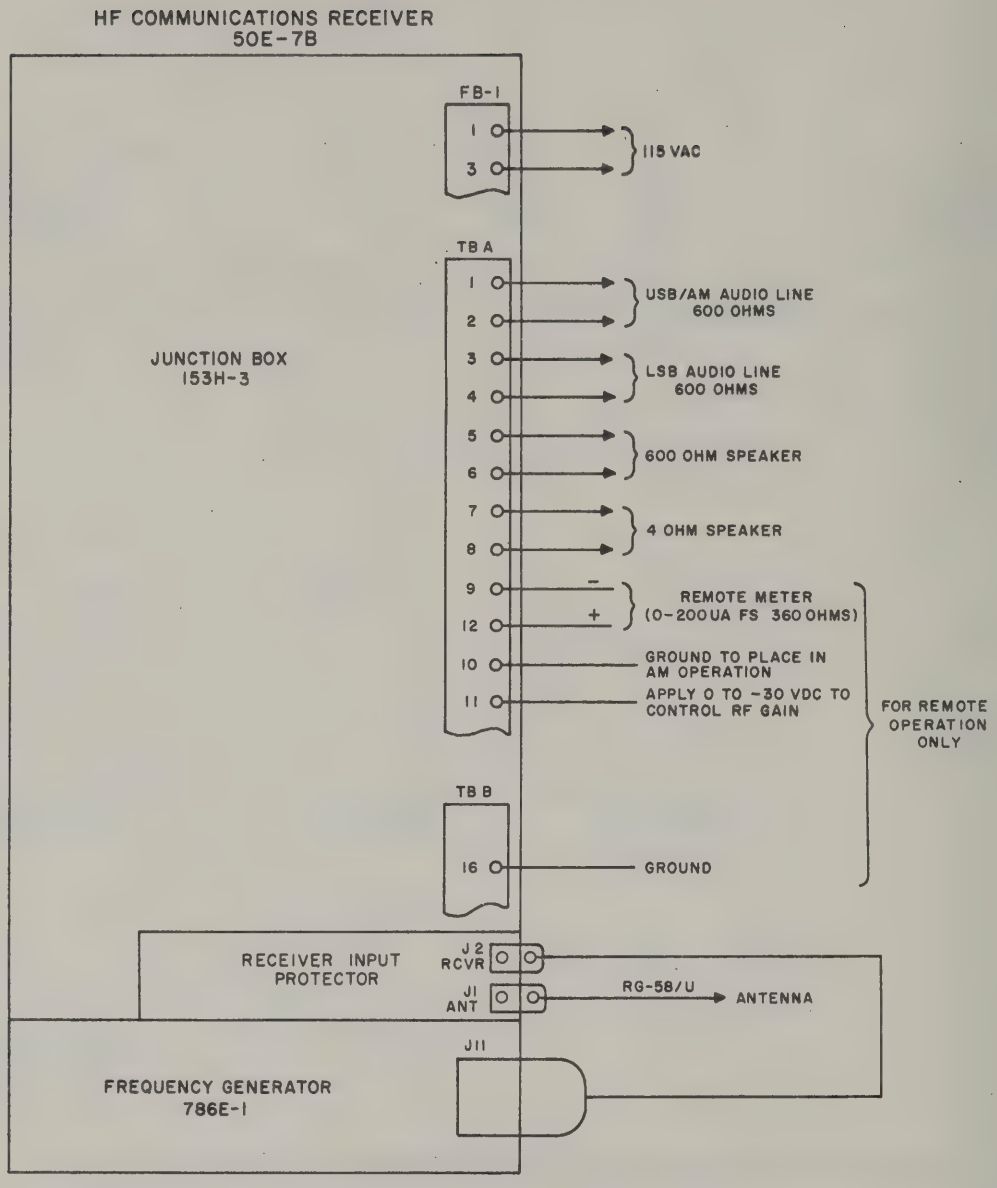
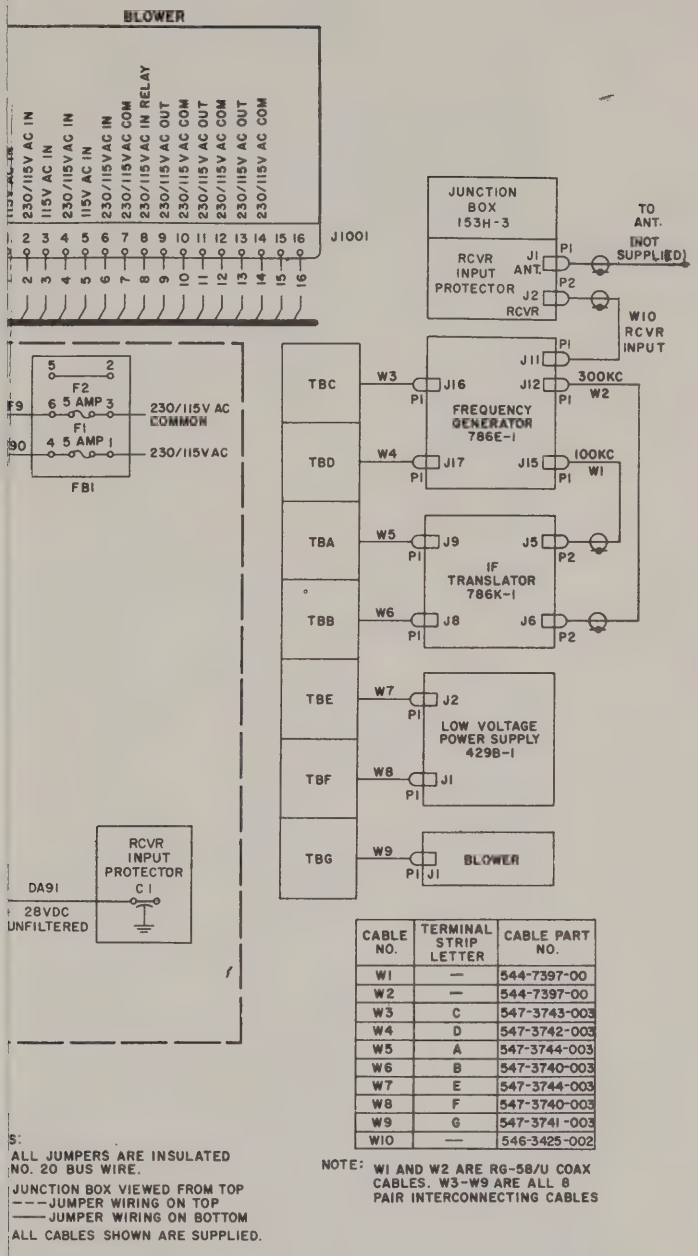


Figure 7-3. H-F Communications Receiver 50E-7B, External Connections for Local and Remote Operation



CABLE NO.	TERMINAL STRIP LETTER	CABLE PART NO.
W1	—	544-7397-00
W2	—	544-7397-00
W3	C	547-3743-003
W4	D	547-3742-003
W5	A	547-3744-003
W6	B	547-3740-003
W7	E	547-3744-003
W8	F	547-3740-003
W9	G	547-3741-003
W10	—	546-3425-002

NOTE: W1 AND W2 ARE RG-58/U COAX CABLES. W3-W9 ARE ALL 8 PAIR INTERCONNECTING CABLES

S:
ALL JUMPERS ARE INSULATED NO. 20 BUS WIRE.
JUNCTION BOX VIEWED FROM TOP
– – – JUMPER WIRING ON TOP
—— JUMPER WIRING ON BOTTOM
ALL CABLES SHOWN ARE SUPPLIED.

Figure 7-4. H-F Communications Receiver 50E-7B, Interconnecting Wiring Diagram

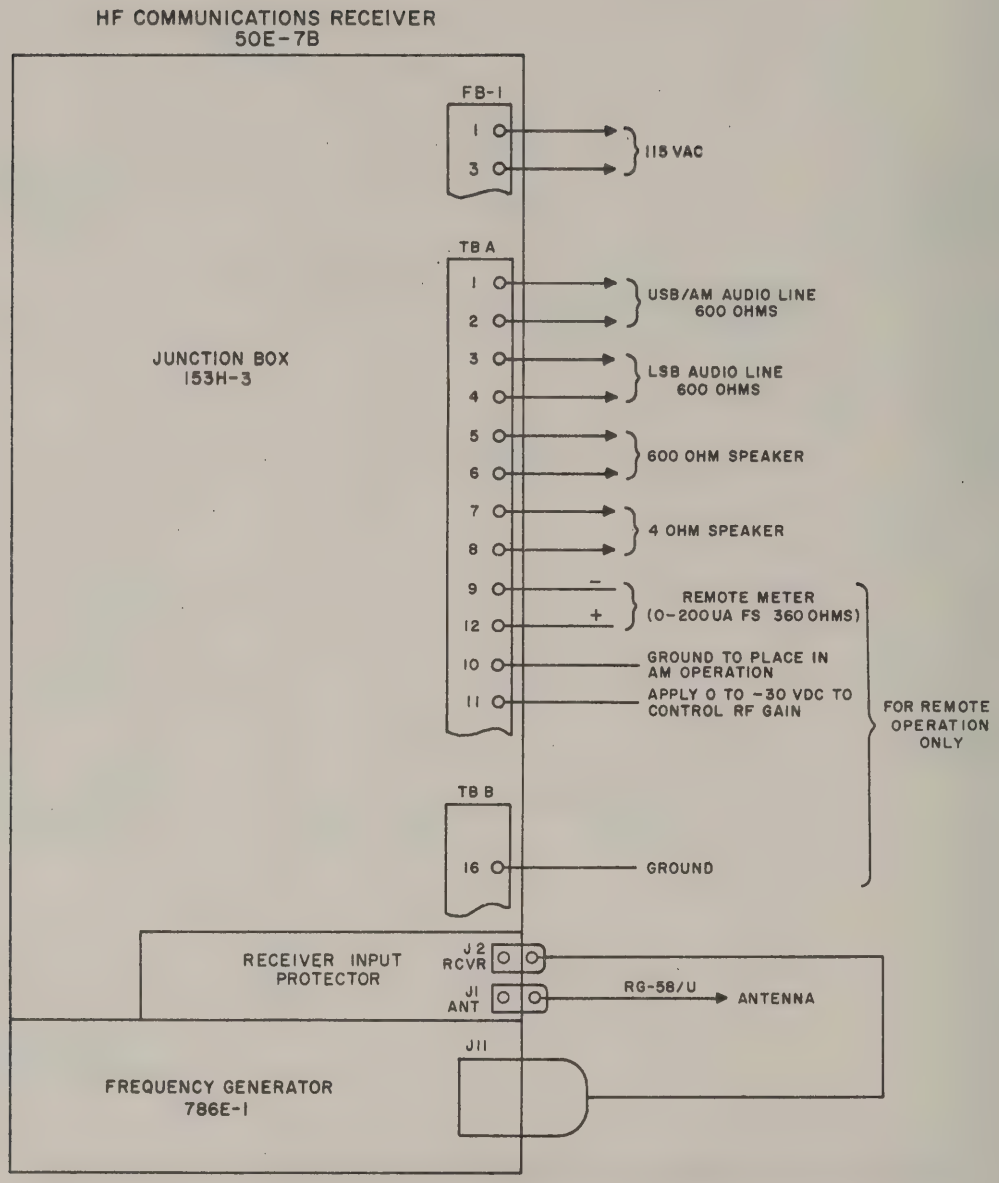
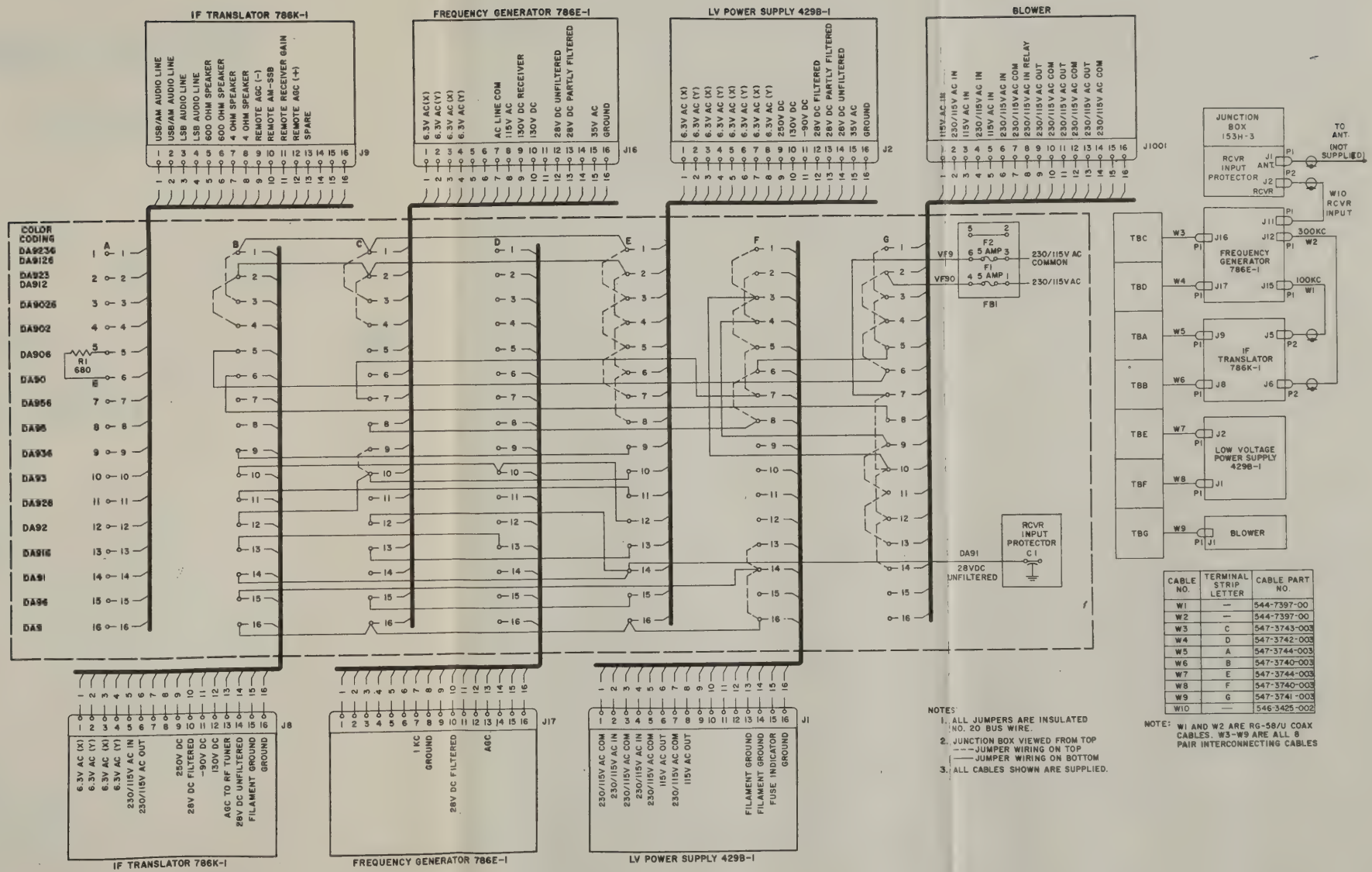


Figure 7-3. H-F Communications Receiver 50E-7B, External Connections for Local and Remote Operation



NOTES:
1. ALL JUMPERS ARE INSULATED NO. 20 BUS WIRE.
2. JUNCTION BOX VIEWED FROM TOP
   - - - JUMPER WIRING ON TOP
   —— JUMPER WIRING ON BOTTOM
3. ALL CABLES SHOWN ARE SUPPLIED.

CABLE NO.	TERMINAL STRIP LETTER	CABLE PART NO.
W1	—	544-7397-00
W2	—	544-7397-00
W3	C	547-3743-003
W4	D	547-3742-003
W5	A	547-3744-003
W6	B	547-3740-003
W7	E	547-3744-003
W8	F	547-3740-003
W9	G	547-3741-003
W10	—	546-3425-002

NOTE: W1 AND W2 ARE RG-58/U COAX CABLES. W3-W9 ARE ALL 8 PAIR INTERCONNECTING CABLES

Figure 7-4. H-F Communications Receiver 50E-7B, Interconnecting Wiring Diagram

FREQUENCY GENERATOR

786E-1

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1958, 1959, 1960, 1961, 1962

CEDAR RAPIDS, IOWA, U.S.A.

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SECTION I
GENERAL DESCRIPTION

1.1 APPLICATION AND DESCRIPTION.

Frequency Generator 786E-1, figure 1-1, is an i-f to r-f translator during transmit condition and an r-f to i-f translator during receive condition. During transmit condition, the 786E-1 accepts the 300-kilocycle single-sideband signal from the sideband generator and translates it to any desired one-kilocycle frequency point in the range of 2.0 to 30.0 megacycles (as selected by the BAND CHANGE and FREQUENCY CHANGE controls on the front panel). During receive condition, the 786E-1 accepts the selected receive signal (as indicated on the band dial) and translates it to a 300-kilocycle i-f frequency for demodulation in the sideband generator.

Frequency Generator 786E-1 consists of a main chassis and the five plug-in modules listed below (see figure 1-2).

a. Stabilized Master Oscillator
b. Frequency Divider

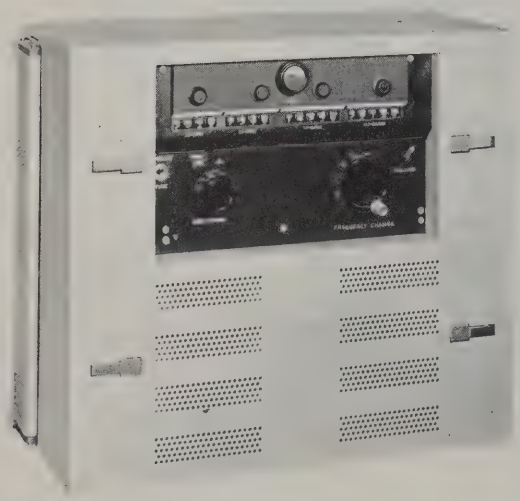


Figure 1-1. Frequency Generator 786E-1

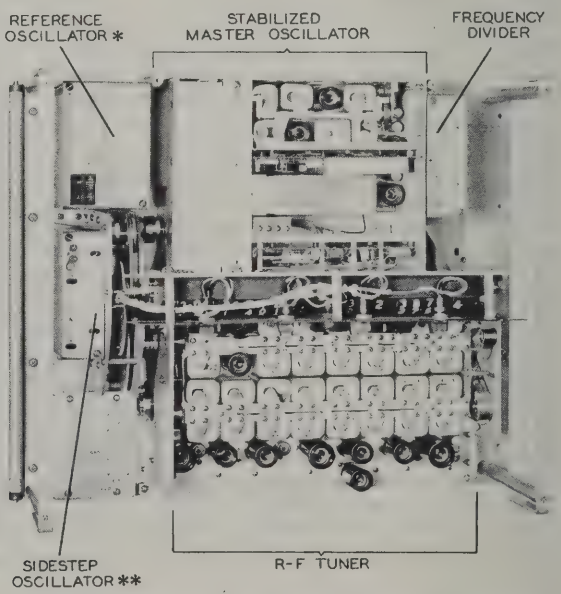


Figure 1-2. Frequency Generator 786E-1 Module Location

c. R-F Tuner
d. Sidestep Oscillator (Optional)
e. Reference Oscillator or Isolation Amplifier

The Sidestep Oscillator module is optional in that it is required only for operation on bands 3-1, 4-1, 4-2, and 4-3. If it is not supplied, a dummy plate will be placed over the hole to prevent air from escaping from the plenum chamber. A Reference Oscillator module or an Isolation Amplifier module will be supplied. The Reference Oscillator module is a self-contained frequency standard. The Isolation Amplifier module is used in place of the Reference Oscillator module when an external 100-kc frequency standard is used. Both modules plug into the same jack.

The main chassis of Frequency Generator 786E-1 mounts in a standard 19-inch open relay rack. The chassis is hinged on the rack to facilitate maintenance and adjustment. The 786E-1 is protected by a metal dust cover secured by thumb-release-type fasteners. A control panel is located by the front of the unit, and all input and output connections are made to two 16-pin connectors and six coaxial-type receptacles at the rear of the unit.

1.2 TECHNICAL CHARACTERISTICS.

Weight. . . . . 41.5 pounds

Dimensions . . . . . 15-5/8 inches high x 18-7/8 inches wide x 7 inches deep

Power Requirements . +28 v d-c, 65 ma, filtered and regulated

+28 v d-c, 580 ma, partially filtered

+28 v d-c, 1100 ma, unfiltered

+130 v d-c, 145 ma, filtered

+250 v d-c, 37 ma, filtered

-90 v d-c, 3 ma, filtered

12.6 v a-c center tapped, 60 cps, 3.7 amp

115 v a-c, 60 cps, 380 ma

Required Rack Space . . . . . 15-3/4 inches

Signal Inputs

Receive . . . . . 2.0 to 30.0 mc at 1.0 microvolt for not less than 10-db signal-plus-noise to noise ratio.

Transmit. . . . . 300 kc at 50 mv to produce 0.2 watt average power at J10.

Signal outputs

Receive . . . . . 300 kc at not less than 100 microvolts with 5 microvolts signal at antenna jack J11.

Transmit. . . . . 2.0 to 30.0 mc at 0.2 watt PEP (minimum) or 0.1 watt average power.

1.3 TUBE AND TRANSISTOR COMPLEMENT.

TABLE 1-1
TUBE AND TRANSISTOR COMPLEMENT

SYMBOL	TYPE	FUNCTION
R-F TUNER MODULE		
V1	5814WA	Transmit/receive low-frequency mixer
V2	5749/6BA6W	Transmitter variable i-f amplifier
V3	5814WA	Transmit/receive h-f mixer
V4	5749/6BA6W	Transmit 1st r-f amplifier
V5	5749/6BA6W	Transmit 2nd r-f amplifier
V6	6CL6	Transmit output power amplifier
V7	5749/6BA6W	Receive variable i-f amplifier
V8	5749/6AK5W	Receive r-f amplifier
V9	5654/6AK5W/6096	Injection frequency multiplier
V10	5749/6BA6	Injection frequency amplifier
STABILIZED MASTER OSCILLATOR MODULE		
A1V1	5899	Amplifier
A1V2	5899	Oscillator (master)
*A2Q1	951	D-c amplifier
*A2Q2	951	D-c amplifier
A2Q3	2N264	I-f amplifier
A2Q4	2N264	I-f amplifier
A2Q5	2N264	I-f amplifier

*Not used in model B or model C stabilized master oscillator.

TABLE 1-1
TUBE AND TRANSISTOR COMPLEMENT (Cont)

SYMBOL	TYPE	FUNCTION
STABILIZED MASTER OSCILLATOR MODULE (Cont)		
A2Q6	2N264	I-f amplifier
A3V1	5636	970- to 1130-kc i-f amplifier
A3V2	5636	3rd mixer
A5V1	5899	Oscillator (interpolation)
A6Q1	2N264	Pulse generator
A6Q2	2N264	Pulse generator
**A8V1	6021	Meter amplifier
A6Q3	2N264	Oscillator
A6V1	5636	4th mixer
A7Q1	2N264	1st 455-kc i-f amplifier
A7Q2	2N264	2nd 455-kc i-f amplifier
A7Q3	2N264	3rd 455-kc i-f amplifier
V1	5654/6AK5W/6096	Frequency multiplier
V2	5750	1st mixer
V3	5654/6AK5W/6096	100-kc amplifier
V4	5670WA	Spectrum generator
REFERENCE OSCILLATOR MODULE		
Q1	2N540	Oven driver amplifier
Q2	2N540	Oven power amplifier
Q3	2N527	Oven voltage amplifier
Q4	2N540	Power amplifier
Q5	2N499	Crystal oscillator
Q6	2N499	3.0-mc buffer amplifier

**Used in model B or model C stabilized master oscillator

TABLE 1-1
TUBE AND TRANSISTOR COMPLEMENT (Cont)

SYMBOL	TYPE	FUNCTION
REFERENCE OSCILLATOR MODULE (Cont)		
Q7	2N499	600-kc mixer
Q8	2N499	600-kc buffer amplifier
Q9	2N499	100-kc mixer
Q10	2N499	2.4-mc multiplier
Q11	2N499	500-kc multiplier
Q12	2N499	2.4-mc output amplifier
Q13	2N264	100-kc output amplifier
SIDESTEP OSCILLATOR MODULE		
Q1	904	1/2 multivibrator
Q2	904	1/2 multivibrator
V1	5636A	Mixer
V2	5636A	Oscillator
V3	5636A	Amplifier
V4	5636A	Mixer
FREQUENCY DIVIDER MODULE		
Q1	2N117	Amplifier
Q2	2N117	1/2 multivibrator
Q3	2N117	1/2 multivibrator
Q4	2N117	1/2 multivibrator
Q5	2N117	1/2 multivibrator
Q6	2N117	1/2 multivibrator
Q7	2N117	1/2 multivibrator
ISOLATION AMPLIFIER		
V1	6AU6	Amplifier
V2	6AU6	Multiplier
V3	6AU6	Multiplier

SECTION II
PRINCIPLES OF OPERATION

2.1 BLOCK DIAGRAM. (Figure 5-1)

2.1.1 GENERAL.

Frequency Generator 786E-1 is an i-f to r-f translator during transmit condition and an r-f to i-f translator during receive condition. In addition, the 786E-1 supplies a 100-kilocycle and a 1-kilocycle output for operation of the sideband generator and the frequency comparator. During transmit condition, the R-F Tuner module accepts the 300-kilocycle single sideband signal from the sideband generator and translates it to any desired one-kilocycle frequency point in the range of 1.7 to 31.7 megacycles. During receive condition, the R-F Tuner module translates a received signal in the same frequency range to a 300-kilocycle i-f frequency for demodulation by the sideband generator. The R-F Tuner module performs a single frequency conversion on the 2.0- to 3.7-mc band and a dual frequency conversion on the 3.7-to 30.0-megacycle bands. The frequency injection necessary for this conversion is supplied to the R-F Tuner module by the SMO (Stabilized Master Oscillator) module. The SMO module supplies an injection frequency of 2 to 4 megacycles in 1/8-kilocycle steps. The SMO module consists of a tuned master oscillator and a frequency correction circuit. The SMO frequency correction circuit compares the master oscillator output to a frequency standard and corrects any error in the master oscillator. The Reference Oscillator, Frequency Divider, and Sidestep Oscillator modules supply injection signals for the operation of the SMO correction circuit. The Reference Oscillator serves as a frequency standard for the 786E-1. If an external frequency standard is used, the Reference Oscillator module is replaced with an Isolation Amplifier module.

2.1.2 R-F TUNER.

The R-F Tuner module is an i-f to r-f translator during transmit condition and an r-f to i-f translator during receive condition. The i-f is 300 kilocycles, and the r-f is manually tuned in one-kilocycle steps over the frequency range of 2.0 to 30.0 megacycles in four bands: (1) 2.0 to 3.7 megacycles, (2) 3.7 to 7.7 megacycles, (3) 7.7 to 15.7 megacycles, and (4) 15.7 to 30.0 megacycles. On band 1, the R-F Tuner module performs a single frequency conversion. On bands 2, 3, and 4, the R-F Tuner module performs a double frequency conversion. On receive operation, the r-f input signal from the transmit-receive relay is fed through keying relay K2 to receive r-f amplifier V8. On bands 2, 3, and 4, the output of V8 is fed to receive h-f mixer V3B where it is converted to a 1.7-to 3.7-megacycle variable i-f signal. On band 1, the output of V8 is fed directly to receiver i-f amplifier V7. The 1.7 to 3.7 megacycle variable i-f signal is amplified by receiver i-f amplifier V7 and fed to receiver i-f mixer V1B where it is converted to a 300-kilocycle fixed i-f signal and fed to the sideband generator. An agc voltage from the sideband generator controls the gain of receiver amplifiers V7 and V8. On transmit operation, the 300-kilocycle fixed i-f signal from the sideband generator is converted to a 1.7-to 3.7-megacycle variable i-f signal by transmit i-f mixer V1A. This signal is amplified by transmit i-f amplifier V2. The gain of V2 is controlled by a transmit gain control (tgc) voltage from the sideband generator. On band 1, the output of V2 is fed through the band-change switch to transmit r-f amplifier V4. On bands 2, 3, and 4, the output of V2 is fed through the band-change switch to transmit h-f mixer V3B where it is converted to an r-f signal in the range of 3.7 to 30.0 megacycles. The transmit h-f mixer V3B is followed by three stages of amplification on band 2 and two stages of amplification on bands 1, 3, and 4. The r-f output is fed to the power amplifier.

Injection signals for the R-F Tuner module mixers are obtained from the SMO module. The 2- to 4-megacycle output signal of the SMO module is fed directly to the transmit and receive i-f mixers on all bands. On band 2, the 2- to 4-megacycle SMO signal is also fed to the receive and transmit h-f mixers through amplifier V10. On band 3, the SMO signal is tripled by multiplier V9 to obtain an h-f mixer injection signal of 6 to 12 megacycles. On band 4, multiplier V9 multiplies the SMO signal by 7 to obtain an h-f mixer injection signal of 14 to 28 megacycles.

2.1.3 STABILIZED MASTER OSCILLATOR.

The Stabilized Master Oscillator (SMO) module consists of a master oscillator and a stabilizing loop that provides error correction for the master oscillator. The master oscillator is an inductance-tuned oscillator that can be mechanically positioned in 0.5-kilocycle increments through the frequency range of 2 to 4 megacycles. Consequently, it is capable of being tuned directly to the 2000 increments required to produce 1-kilocycle R-F Tuner module channels in band 1 and the 4000 increments required to produce 1-kilocycle R-F Tuner module channels in band 2. Bands 3 and 4 of the R-F Tuner module, containing 8000 and 16,000 one-kilocycle channels, respectively, require the master oscillator to produce a greater number of injection frequencies than are possible with the mechanical positioning device. Generation of the additional increments is accomplished by mechanically positioning the master oscillator to the nearest lower

0.5-kilocycle increment and then operating the stabilizing loop to electronically position the master oscillator to the additional required increments. Electronic tuning of the master oscillator is accomplished by two different methods, depending on the type number of the SMO (see paragraph 2.2.4). The master oscillator output frequency can be determined by the following formula:

$$F_{MO} = \frac{DIAL + ADD + 300}{BAND\ MULT}$$

Where: F_{MO} = the master oscillator frequency in kilocycles

DIAL = the Frequency Generator 786E-1 dial frequency

300 = the 300-kilocycle fixed i-f subtracted in the r-f tuner i-f mixer

BAND MULT = Multiplication of the master oscillator frequency in the R-F Tuner module

Band 1 = 1
Band 2 = 2
Band 3 = 4
Band 4 = 8

ADD = The ADD KC indication on the band-change switch.

The master oscillator stabilizing loop electronically tunes the master oscillator to the desired frequency and phase locks it to the reference oscillator thereby maintaining a master oscillator accuracy and stability equal to that of the Reference Oscillator module. This is accomplished by comparing the master oscillator signal to the reference oscillator signal in a frequency and phase discriminator. The stabilizing loop sequence is as follows: The 2-to 4-megacycle output of the master oscillator is multiplied by eight and applied to mixer V2 where it is beat with a selected 100-kilocycle spectrum point from the 100-kilocycle spectrum generator. The triggering signal for the 100-kilocycle spectrum generator is obtained from the Reference Oscillator module. The output of mixer V2 is filtered to obtain a difference frequency between 3.4 and 3.5 megacycles and applied to mixer A3V1 where it is beat with a signal from the Sidestep Oscillator module or Reference Oscillator module. The sidestep oscillator injection is used to obtain, electronically, the frequency increments that cannot be obtained by mechanically tuning the master oscillator. The output of mixer A3V1 is filtered to obtain a difference frequency between 970 and 1130 kilocycles and applied to mixer A3V2 where it is beat with a signal from the interpolation oscillator. The interpolation oscillator, which is tuned by the mechanical tuning shaft, supplies an injection signal which will produce a mixer A3V2 difference frequency, F_4, equal to 455 kilocycles plus the master oscillator error and the interpolation oscillator error. The output of mixer A3V2 is filtered to obtain F_4 which is applied to the phase and frequency discriminator where it is compared with the reference frequency F_{REF}. The reference frequency is generated by converting a 4-kilocycle signal from the Frequency Divider module to a 4-kilocycle spectrum in the 1000- to 1100-kilocycle range and mixing it with the interpolation oscillator signal to obtain a reference signal, F_{REF}, equal to 455 kilocycles plus the interpolation oscillator error. The interpolation error, which is present in both F_{REF} and F_4, is balanced out in the phase and frequency discriminator. During setup the master oscillator frequency is incorrect, resulting in F_4 being above or below 455 kilocycles, and frequency discrimination pulls the master oscillator toward the proper frequency. When F_4 reaches 455 kilocycles, phase discrimination results in an electrical tuning current output which phase locks the master oscillator on frequency. In the phase lock condition, the master oscillator output assumes the correct phase $\emptyset_{COR}$ so that the phase discrimination with $\emptyset_{REF}$ produces an output which maintains equilibrium in the stabilizing loop and holds the master oscillator on frequency. In the phase lock condition, F_{MO} tracks F_{REF} resulting in a master oscillator stability equal to the reference frequency stability.

2.1.4 SIDESTEP OSCILLATOR.

The Sidestep Oscillator module provides the injection frequency for the second mixer of the SMO module. This injection frequency is sidestepped by 1, 2, or 3 kilocycles to obtain the electronic tuning necessary to supplement the mechanical tuning of the SMO module master oscillator. The sidestep oscillator is not used on band 1, band 2, band 3 add 0, and band 4 add 0. On these bands, the 2400-kilocycle signal from the reference oscillator module is fed directly to the second mixer of the SMO by relay K1. When the band switch is in the add 1, add 2, or add 3 position, relay K1 is energized and the output of the Sidestep Oscillator is fed to the second mixer of the SMO. On band 4 add 1, the Sidestep Oscillator output frequency is 2399 kilocycles. On band 4 add 2 and band 3 add 1, the output frequency is 2398 kilocycles. On band 4 add 3, the output frequency is 2397 kilocycles.

The Sidestep Oscillator consists of a pulse generator, a subtractive mixer, a band-pass filter, an additive mixer, and a crystal-controlled oscillator operating on one of four frequencies spaced one kilocycle apart. The pulse generator is driven by a 1-kilocycle signal from the Frequency Divider and produces a 1-kilocycle keying pulse that is used to key subtractive mixer V1 into conduction at a 1-kilocycle rate. This action causes the 2.4-megacycle signal, injected to the mixer from the reference oscillator module, to have a 1-kilocycle spectrum impressed upon it in the mixer tube. The subtractive mixer also receives an injection signal from the crystal-controlled oscillator which may be 1.945, 1.944, 1.943, or 1.942 megacycles, depending on the control of crystal selection relays K1 and K2. This crystal oscillator signal is beat

with a 1-kilocycle spectrum point of the 2.4-megacycle signal to produce a 455-kilocycle difference frequency. A band-pass mechanical filter immediately following the subtractive mixer has adequate rejection to adjacent 1-kilocycle spectrum points but a sufficient band-pass width to accommodate the crystal oscillator error. The 455-kilocycle signal, plus or minus any oscillator error, is amplified by an amplifier stage and applied to an additive mixer. The crystal oscillator signal is also injected into the additive mixer and combines with the 455-kilocycle signal to produce a sidestep output signal on one of four frequencies: 2.400, 2.399, 2.398, or 2.397 megacycles. The use of a subtractive mixer and then an additive mixer cancels the crystal oscillator error, resulting in a sidestep oscillator stability equal to the Reference Oscillator.

2.1.5 FREQUENCY DIVIDER.

The Frequency Divider module supplies a 4-kilocycle signal to the SMO module and a 1-kilocycle signal to the Sidestep Oscillator module. The module consists of an amplifier and three multivibrator-type frequency dividers. The 100-kilocycle signal from the Reference Oscillator module is amplified by Q1 and divided to 20 kilocycles by multivibrator Q2 and Q3. The 20-kilocycle signal is divided to four kilocycles by the multivibrator, Q4 and Q5, and the four-kilocycle signal is divided to one kilocycle by the multivibrator, Q6 and Q7. Since the 4-kilocycle and 1-kilocycle signals are derived from the 100-kilocycle input signal, their accuracy stability is equal to that of the Reference Oscillator.

2.1.6 REFERENCE OSCILLATOR.

The Reference Oscillator module provides the basic reference frequencies of 100 kilocycles and 2.4 megacycles for the entire equipment. The reference oscillator signal is generated by a 3-megacycle, crystal-controlled oscillator. The oscillator crystal is enclosed in a temperature-controlled electronic oven. The oven control circuit consists of a transistorized audio-frequency amplifier tuned to 5 kilocycles, with a positive feedback from output to input through a temperature sensitive bridge. As a result of the positive feedback, the amplifier oscillates, thus delivering a-c power to the bridge which also acts as an oven heater. As the oven bridge heats, the bridge approaches the point where the attenuation of the bridge equals the gain of the amplifier, at which time, steady state oscillation exists. This point is a few hundredths of a degree below the true balance temperature of the bridge and is independent of the power required to maintain this temperature. The oven has no temperature cycling and will hold the temperature of the oven, and therefore the crystal, within 0.1 degree centigrade over an ambient temperature range of -55 degrees centigrade to +70 degrees centigrade. The 3-megacycle output of the crystal oscillator is coupled to a regenerative divider circuit consisting of subtractive mixer Q7 and times 4 multiplier Q10. The 2.4-megacycle output of this divider is fed to the Sidestep Oscillator module through output amplifier Q12. The 600-kilocycle output of the divider is fed through buffer amplifier Q8 to another regenerative divider consisting of subtractive mixer Q9 and times 5 multiplier Q11. The 100-kilocycle output of the divider is amplified by output amplifier Q13 and used as the equipment frequency standard having a long term stability of one part per million.

2.1.7 ISOLATION AMPLIFIER.

The Isolation Amplifier module replaces the Reference Oscillator module when an external 100-kilocycle standard is used. For the schematic diagram, see figure 5-11. The Isolation Amplifier module provides isolation from the external standard and, in addition to the 100-kilocycle output, supplies the 2.4-megacycle signal required for operation of the Sidestep Oscillator and Stabilized Master Oscillator modules. The Isolation Amplifier module consists of a 100-kilocycle amplifier, a times 6 multiplier, and a times 4 multiplier. The 100-kilocycle amplifier provides isolation between the 100-kilocycle standard input and the 100-kilocycle Isolation Amplifier output. In addition, the 100-kilocycle amplifier supplies a signal to the times 6 multiplier. The 600-kilocycle output of the times 6 multiplier is fed to a times 4 multiplier which provides a 2.4-megacycle output for the Sidestep Oscillator module.

2.2 DETAILED CIRCUIT DESCRIPTION.

2.2.1 R-F TUNER MODULE, MODEL B.

A modified R-F Tuner (model B) is interchangeable with the original model R-F Tuner. Refer to figure 5-3 for the schematic of the model B R-F Tuner. Basically, the model B R-F Tuner is the same as the original tuner, except the molded coils have been replaced with conventional coils and some of tuning cores were changed for improved tracking. By replacing molded coils with conventional coils, the torque necessary to drive the slug rack is reduced from 1 inch-pound to 3/4 inch-pound. This decreased torque due to decreased drag allows more accurate core positioning resulting in better coil tracking. Also several capacitors and resistors were changed for improved gain characteristics. The following circuit descriptions apply to both R-F Tuners.

2.2.2 R-F TUNER MODULE, TRANSMIT FUNCTION.

Figure 5-2 is a schematic diagram of the model A R-F Tuner module. The 300-kilocycle i-f signal is coupled to the control grid of the transmitter low-frequency mixer, V1A. The 300-kilocycle i-f signal mixes with the 2.0- to 4.0-megacycle injection signal from the SMO module to produce 1.7- to 3.7-megacycle output from mixer V1A. The 2.0- to 4.0-megacycle injection frequency is coupled from pin 2 of receptacle P1 through a parallel-tuned circuit consisting of C118, C119, C120, and the primary winding of transformer T7. Output is taken from the secondary winding of T7 and coupled through capacitor C94 for cathode injection into V1A. Since V1A is a subtractive mixer,

the injection of the 300-kilocyle i-f signal and the 2.0- to 4.0-megacycle signals produces an output of 1.7 to 3.7 megacycles, or the variable i-f frequency band. The output from V1A plate is tuned by Z1, Z2, and Z3 and coupled through C11 to the control grid of the variable i-f amplifier stage, V2, The gain of V2 is controlled by EXCITER RF GAIN control on the sideband generator. The tgc voltage (received from the tgc module of the sideband generator) prevents extreme overdriving of the P.A. module on peak signals. The amplified output of V2 is developed across the following interstage tuning circuits Z4, Z5, and Z6 and applied to band switch S2. The bands consist of the following frequencies:

Band 1 - 2.0 to 3.7 megacycles
Band 2 - 3.7 to 7.7 megacycles
Band 3 - 7.7 to 15.7 megacycles
Band 4 - 15.7 to 30.0 megacycles

Since the band 1 frequencies coincide with the variable i-f frequencies, no additional frequency conversion is necessary for band 1. Band 1 signals are bypassed around the transmitter high-frequency mixer, V3A, coupled through band switch S5 and capacitor C46, and applied to the control grid of the transmitter r-f amplifier, V4.

Since bands 2, 3, and 4 are higher frequencies than the variable i-f frequencies, additional frequency conversion of the variable i-f frequencies is necessary. When band 2 is selected, the variable i-f frequency signal is coupled through the band 2 position of band switch S2 and capacitor C26 and applied to the control grid of the transmitter high-frequency mixer, V3A. The 2.0- to 4.0-mc signal from T7 is coupled through band switch S12 and applied to the control grid, pin 1, of an amplifier stage, V10. The output from V10 is connected through band switch S14 and appears across Z28 in parallel with C177 and C178 which were inserted into the circuit by S14 for band 2 only. The signal from Z28 is coupled through band switch S15 and capacitor C174 and cathode injected into the transmitter high-frequency mixer, V3A. V3A is an additive mixer operating only during transmit operation. The injection of the variable i-f frequency of 1.7 to 3.7 megacycles and the 2.0- to 4.0-megacycle amplified SMO signal results in an output of 3.7 to 7.7 megacycles, or band 2. This signal from V3A plate is developed across the band 2 interstage tuning circuits, Z7 and Z8, coupled through band switch S5 and capacitor C46, and impressed on the control grid of the transmitter r-f amplifier, V4.

When band 3 is selected, the variable i-f signal is applied to the transmitter high-frequency mixer, V3A. The 2.0- to 4.0-megacycle signal from the parallel-tuned circuit, consisting of C118, C119, C120 and the primary winding of T7, is coupled through capacitor C121 to the control grid of multiplier, V9. The band 3 tuning circuit of Z26 and Z27 of V9 is tuned to three times the input frequency and causes the input to be tripled at the plate tank output. This 6.0- to 12.0-megacycle signal is coupled through band switch S12 and applied to the control grid, pin 1, of amplifier V10. The plate output of V10 is coupled through band switch S14, the band 3 tuned circuit of Z28, band switch S15, and capacitor C174 to the cathode of transmitter high-frequency mixer V3A. The mixing of the 1.7- to 3.7-variable i-f frequency and the 6.0- to 12.0-megacycle signal results in a 7.7- to 15.7-megacycle signal (band 3) which appears across the band 3 tuning circuits, Z9 and Z10, following V3A. This signal is coupled through band switch S5 and capacitor C46 and applied to the control grid of the transmitter r-f amplifier, V4.

When band 4 is selected, the variable i-f signal is mixed in the transmitter high-frequency mixer, V3A, with seventh harmonic of the 2.0- to 4.0-megacycle SMO signal. The multiplier, V9, with the band switches inserting the band 4 tuning circuit of Z26 and Z27 into the plate circuit, produces an output frequency band of 14.0 to 28.0 megacycles. This signal is amplified by amplifier V10 and cathode injected into the transmitter high-frequency mixer, V3A. The mixing action produces an output frequency band of 15.7 to 31.7 megacycles which is developed across the band 4 triple-tuned circuits, Z11, Z12, and Z13. This signal is coupled through band switch S5 and capacitor C46 and applied to the control grid of the transmitter r-f amplifier, V4.

The output of V4 plate is developed across the selected interstage tuning circuits. The outputs for bands 1, 3, or 4 are taken from the capacitive voltage dividers of Z14, Z16 and Z17, respectively, and applied to band switch S8. From S8 the selected signal is coupled to band switch S9, through current-limiting resistor R13, and applied to the control grid of the transmitter output amplifier, V6. The V4 output for band 2 is connected from the capacitive voltage divider, C52 and C53 of Z15, to the control grid of an additional stage of r-f amplification, V5. V5 and the triple-tuned circuits immediately following are required for band 2 only. The function of the triple-tuned circuits provide additional selectivity for rejection of the second harmonic frequencies of the variable i-f amplifier stages and SMO signals which fall within the band 2 frequencies. V5 provides amplification to overcome the losses of the additional tuned circuits. The output of V5 is tuned by Z18, Z19, and Z20, coupled through band switch S9 and current limiting resistor R13, and applied to the control grid of the transmitter output amplifier, V6. The output of V6 is taken from the plate pin 6 and developed across the tuned circuit provided for the selected band. The 0.2-watt (nominal) PEP signal is taken from a capacitive voltage divider of Z21, Z22, Z23, or Z24, depending on which is selected, coupled through band switch S11, and applied to receptacle P1-5 for delivery to the power amplifier.

Operation of band switches S1 through S16 controls the selection of the interstage parallel-tuned coupling circuits and is performed by band motor B1. B1 and the band switches geared to it are operated by a relay-drive type of band-switching circuit that initiates

operation when the equipment is turned on. Control of the band-switching circuit depends on a ground being supplied on one of the four control lines, A, B, C, or D, when band selection is made with the BAND CHANGE - ADD KC control on the front panel. The band-switching circuit is a ground-seeking type in which band motor B1 will operate, driving the switches geared to it, until the rotor tab of S16 is positioned to the grounded control line. When this occurs, the grounded control line energizes the coil of band relay K1 and closes its contacts. The closing of K1 contacts removes the motor driving power from B1, causing it to stop, with the band switches in the selected band position.

The interstage, parallel-tuned circuits used in the R-F Tuner module have a band pass of 16 kilocycles, and each consists basically of a coil, a variable capacitor, and a fixed capacitor contained in separate plug-in subassemblies for ease of replacement when servicing. The variable capacitors permit individual tracking adjustments of the tuning circuits, while the variable coils permit simultaneous tuning of the interstage tuning circuits. The coils in this unit are of the permeability-tuned type in which the coil is tuned by positioning the core of the coil. The cores of all the interstage tuning circuit coils are mechanically connected to a rack which is raised or lowered through a gear arrangement by the FREQUENCY CHANGE control on the front panel. The coil cores attached to the rack are provided with adjustable screws to permit tracking adjustments.

The R-F Tuner module normally is in receive condition and requires control to transfer it to transmit condition. This provision is accomplished by the use of three keying relays. The keying relay located on the sideband generator transfers the +130-volt d-c plate supply from the receive tubes to the transmit tubes, or the reverse. Keying relay K2 located in the R-F Tuner module couples the received r-f signal to the receive circuits and, in addition, supplies an additional bias to the receive tubes during transmit operation. The bias provision prevents control grids of receive tubes from acting as coupling elements which would produce oscillations in the transmit tubes because of the common use of the interstage coupling and tuned circuits. The bias voltage of approximately -90 volts d-c is connected from P2-14 through contacts of keying relay K2 to the grid circuits of both receive mixers, the variable i-f amplifier, and the receiver r-f amplifier. A third keying relay located in the antenna network transfers the antenna from the receive circuits to the transmit circuits, or the reverse. All keying relays are actuated when a ground is placed on the key line.

2.2.3 R-F TUNER MODULE, RECEIVE FUNCTION.

The r-f signal from receptacle P1-14 is connected through normally closed contacts of keying relay K2, through band switch section S7, and across selected tuning circuit Z14, Z15, Z16, or Z17 to the control grid of the receiver r-f amplifier, V8. The amplified output of V8 is taken from the plate, coupled through band switch S5, and developed across the interstage tuning circuits. The signal then is coupled through S3 and capacitor C109 to the control grid of the receiver high-frequency mixer, V3B. Since the band 1 frequencies of 1.7 to 3.7 megacycles correspond to the variable i-f frequency band, no high-frequency conversion is necessary, and band 1 frequencies are bypassed around the receiver high-frequency mixer, V3B, through band switches S5 and S2. The signal taken from S2 is developed across the interstage tuning circuits, coupled through capacitor C13, and applied to the control grid of the receiver variable i-f amplifier, V7. Bands 2, 3, and 4 require frequency conversion down to the receiver variable i-f frequency range in the receiver high-frequency mixer, V3B. The same injection frequencies are used that were employed in the high-frequency mixer of the transmit operation of the R-F Tuner module, these being 2.0 to 4.0 megacycles for band 2, 6.0 to 12.0 megacycles for band 3, and 14.0 to 28.0 megacycles for band 4. The difference frequency output band of the receiver high-frequency mixer is the same for bands 2, 3, and 4, this being the variable i-f frequency band of 1.7 to 3.7 megacycles. This signal is coupled through band switch S2, across the interstage tuning circuits for additional gain and selectivity, and through capacitor C13 to the control grid of the variable i-f amplifier, V7. The amplified output of V7 is developed across the interstage tuning circuits for additional gain and selectivity, coupled through C1, and applied to the control grid of the receiver low-frequency mixer, V1B. The 2.0- to 4.0-megacycle signal from the secondary winding of transformer T7 is cathode injected into V1B and beat with the variable i-f frequency band to produce a 300-kilocycle i-f frequency containing the audio intelligence. The 300-kilocycle plate output signal of V1B is coupled through variable output transformer T2 and applied to receptacle P1-11 of the R-F Tuner module for delivery to the i-f amplifiers of the sideband generator. The receiver tubes of the R-F Tuner module are provided with agc voltage from the sideband generator to assist in maintaining a nearly constant gain. The agc voltage is fed in through terminal 21 of receptacle P2 and applied to the control grids of receiver variable i-f amplifier and r-f amplifier tubes. In addition, these two stages have their gain controlled, along with that of the i-f amplifiers in the sideband generator, by a manually adjusted RECEIVER RF GAIN control on the sideband generator. This control sets a bias voltage threshold on the agc bus. Tuning and band switching of the interstage tuning circuits is accomplished in the same manner as for the transmit operation of the R-F Tuner module.

2.2.4 STABILIZED MASTER OSCILLATOR MODULE.

2.2.4.1 STABILIZED MASTER OSCILLATOR, MODEL B. A modified stabilized master oscillator (SMO) (model B) is interchangeable with the original stabilized master oscillator. Refer to figure 5-8 for the model B SMO schematic diagram. The model B

stabilized master oscillator incorporates a different type of frequency control and has been assigned type number 70H-13A to identify this change. The modification replaces the saturable reactor with a silicon capacitor (Varicap) as the frequency controlling component.

In conjunction with this frequency control change, the signal i-f discriminator board is changed to incorporate a compatible frequency discriminator. Also to accommodate the AFC meter to the discriminator circuit, an AFC meter amplifier board is added in the stabilized master oscillator.

NOTE

The changes made to the stabilized master oscillator are internal only. Therefore, Varicap model (model B) as a complete module is electrically and mechanically interchangeable with the original stabilized master oscillator. However, the removable subassemblies that are changed are not interchangeable between the model B and the original stabilized master oscillator.

At the time of development of the original stabilized master oscillator, the most practical type of electronic frequency control was the saturable reactor. A saturable reactor, being driven by a current source, requires considerable power. However, the silicon capacitor, being a diode which exhibits a change in capacity as the voltage across it changes, is a high-impedance, voltage-driven device which requires little power. Consequently, the d-c amplifier used in the original design was eliminated. Separate phase and frequency discriminators are used. This permits separate phase and gain adjustments to achieve maximum frequency discriminator pull-in, maximum phase discriminator pull-in, and a safe margin of gain to prevent loop instability.

2.2.4.2 STABILIZED MASTER OSCILLATOR, MODEL C. The model C stabilized master oscillator (SMO) is interchangeable with the original and model B stabilized master oscillators. Refer to figure 5-9 for model C schematic diagram. The model C stabilized master oscillator differs from the model B in that an LC network band-pass filter replaces the mechanical filter in the i-f mixer board circuitry. With the LC network band-pass filter of the model C stabilized master oscillator, the stabilizing loop pull-in range is increased to approximately ±4 kc.

The following circuit descriptions apply to all three stabilized master oscillators.

2.2.4.3 MASTER OSCILLATOR SUBASSEMBLY. The master oscillator subassembly contains a modified Hartley oscillator and a buffer amplifier stage. The master oscillator furnishes the injection frequencies for the frequency conversion circuits of the R-F Tuner module. The operating frequency of the master oscillator, A1V2, is determined by the parallel-tuned circuit in its control grid circuit that can be mechanically and electronically tuned through the frequency range of 2.0 to 4.0 megacycles in the 125-cycle-per-second steps. A1V2 is a pentode in which the screen grid is used as the plate of the oscillator. The control grid tank circuit consists of several components of which A1L1 functions as the main tuning inductance and A1C8 as the main tuning capacitor. Inductor A1L1 is permeability tuned by means of a ten-turn tuning core that is mechanically geared to the FREQUENCY CHANGE control on the front panel. A1L1 also provides the inductive feedback to the cathode of A1V2, A1Z1, also located in the tank circuit, contains saturable reactor A1T1, capacitor A1C10, and coil A1L2 which is provided for tracking adjustments. A1T1 is used to permit positioning of the master oscillator to the additional one-quarter and one-eighth kilocycle increments necessary for output bands 3 and 4 and, in addition, is used to provide correction for master oscillator frequency drift. The plate output of A1V2 is a frequency in the range of 2.0 to 4.0 megacycles which is coupled through capacitor A1C1 and applied to the control grid of buffer amplifier A1V1. This stages amplifies the signal and isolates the master oscillator from load changes. The signal is taken from the plate of A1V1, coupled through receptacle A1P1 and coaxial cable, and applied to the r-f tuner subassembly.

The master oscillator subassembly of all SMO modules is provided with a heater element. Element HR1 maintains the subassembly above +25 degrees centigrade (+77 degrees Fahrenheit). Thermal switch S1 removes the a-c power to HR1 when +25 degrees centigrade is attained. Another thermal switch, S2, prevents output of the master oscillator until its internal temperature reaches +20 degrees centigrade. The heater element stabilizes components of the master oscillator and maintains the oscillator subassembly moisture free. The signal i-f amplifier subassembly of the model A SMO also contains a heater element. This heater element is wound around a compartment that contains the temperature-sensitive components of the phase and frequency discriminator. The temperature is maintained at +75 degrees centigrade. Transistors A2Q1 and A2Q2 are matched per operation at this temperature.

2.2.4.4 MASTER OSCILLATOR 70H-13A (MODEL B AND MODEL C SMO MODULES). The master oscillator used in the model B and model C stabilized master oscillators uses Varicap frequency control. Refer to figure 5-8 or 5-9 for the schematic diagram. Capacitor A1C11, a voltage variable capacitor, located in the tank circuit positions the master oscillator to the additional 0.125- and 0.250-kilocycle increments necessary for output on bands 3 and 4 respectively, and, in addition, is used to provide correction for master oscillator frequency shift. Operation of A1C11 is deferred until discussion of the phase and frequency discriminator circuits of the i-f signal amplifier subassembly. Inductor A1L2 in the tank circuit is for tuning adjustment.

2.2.4.5 R-F TUNER SUBASSEMBLY. In the r-f tuner subassembly of the SMO, the signal is impressed across a parallel-tuned circuit Z1 which acts both as a coupling circuit for the SMO output and a tank circuit for buffer amplifier A1V1. Z1 consists of transformer T1 and capacitors C3 and C4. Variable capacitor C3 permits tracking adjustments of the tuned circuit. The secondary winding of T1 couples the SMO output signal to receptacle P1 for external use. Z1 is used for signal cleanup and appears as a 50-ohm source to the r-f tuner. The signal developed across the tuned circuit is supplied as a driving source to a multiplier stage. The first frequency multiplication occurs in a bridge circuit consisting of four crystals diodes CR1, CR2, CR3, and CR4. The bridge is connected as a full-wave rectifier which provides an output ripple frequency of twice the input signal frequency. Therefore, the output of the bridge circuit is a frequency in the 4.0- to 8.0-megacycle frequency band which appears across Z2. Z2 contains a coupling transformer T2 which has its secondary winding used as the coil of a parallel-tuned circuit in which capacitors C7 and C8 are the paralleling capacitors. Variable capacitor C7 is provided for tracking adjustments. The signal appearing across Z2 is direct coupled to the control grid of second multiplier stage, V1. V1 is heavily overdriven to produce harmonics and has its plate output developed across parallel-tuned circuit Z3, which consists of a variable coil L2 and capacitors C11 and C12. Variable capacitor C12 permits tracking adjustment of the Z3 operating frequency. The output signal appearing across Z3 is 16.0 to 32.0 megacycles which is coupled through C14 and applied to the control grid of the first mixer, V2.

The 100-kilocycle signal from the Reference Oscillator module is coupled into the SMO through terminal 11 of receptacle P1. From P1-11, the signal is coupled through isolation resistor R3 and applied to a tap of tuned circuit L3-C20. The signal appearing across L3-C20 is clipped and squared by CR7 and applied to the control grid of a pentode amplifier, V3. V3 is operated with zero bias on the control grid and is driven to grid limiting during the negative alternations of the driving signal. This type of operation produces a 50-percent duty cycle square wave which has some positive d-c average. The square-wave signal is coupled through C24 and applied to the control grid of a dual-triode spectrum generator, V4. The spectrum generator, V4, connected in a cathode-coupled multivibrator circuit, generates a spectrum of 100-kilocycle increments. Crystal diodes CR5 and CR6 "square up" the leading edges of the square-wave input signal and limit the signal to positive values. The section of V4 consisting of leads 2, 3, and 4 normally is in nonconducting condition and does not operate until the arrival of the square-wave pulse on the control grid, lead 3. The section of V4 consisting of pins 6, 7, and 8 normally is conducting. The arrival of a pulse on the control grid, lead 3, triggers the left half of V4 into conduction where it remains as long as the positive pulse is present and causes the right half to cut off. When the pulse has passed, the left half of V4 returns to nonconducting condition, and the right half returns to conducting condition. The arrival of each 100-kilocycle square-wave pulse will cause a recurrence of the above sequence. This circuit is prevented from being a free-running multivibrator by the use of a common bias resistor R18 and capacitor C26 in the cathode circuit of V4. The current flowing through R18 and the right half of V4, when no pulse is present on the control grid of the first section, creates a bias on the cathode of crystal diode CR6. The signal impressed on the control grid, lead 3, on the left section of V4 must overcome this bias before the left half will conduct. The feedback path for the multivibrator is through C27 for the plate circuit and through C25 for the cathode circuit. The output of V4 is taken from the plate circuit and consists of a burst of 100-kilocycle multiples. This signal is applied across two parallel-tuned circuits which may be tuned to frequencies in the band of 19.5 to 35.5 megacycles. The 100-kilocycle spectrum frequency at which the tuned circuits resonate is selected when the FREQUENCY CHANGE control is operated, since all tuned circuits in the 786E-1 are mechanically ganged. The selected 100-kilocycle spectrum point of the 19.5- to 35.5-megacycle band is delivered to first mixer V2 as an injection signal to the control grid. Tuned circuits Z4 and Z5 are mechanically positioned to operate at a 100-kilocycle spectrum point frequency which will beat with the multiplied master oscillator signal present on the control gird to produce a difference signal within the 3.37- to 3.53-megacycle pass band of filter FL1.

2.2.4.6 I-F MIXERS SUBASSEMBLY. Two types of i-f mixers subassemblies are used. The i-f mixer subassembly used with the model A and model B stabilized master oscillator module has a mechanical filter (A3FL2). In the i-f mixers subassembly used with the model C SMO, A3FL2 is an LC filter. The value of some of the components of the two types is somewhat different also, but basically the difference is in the filter. The LC filter has a 60-kilocycle nose and the mechanical filter has a 40-kilocycle nose. The output taken from FL1 of the r-f tuner subassembly is fed into the i-f mixers subassembly and applied to the control grid (pin 1) of second mixer A3V1. A mixing signal from the Sidestep Oscillator module and/or the Reference Oscillator module (2.4, 2.399, 2.398, or 2.397 megacycles) is introduced through tuned transformer A3T1 and applied to the suppressor grid (pin 4) of A3V1. The output is passed through a 970- to 1130-kilocycle pass-band filter, A3FL1, to obtain the difference frequency. The output of the filter is applied to the suppressor grid (pin 4) of third mixer A3V2. The signal on the suppressor and control grids mix in the electron stream of A3V2 with the 455-kilocycle difference frequency selected by filter A3FL2. Filter A3FL2 has a 40- or 60-kilocycle band-pass characteristic which passes the multiplied positioning or correction error. Mechanical filter A3FL2 (used in model A SMO and model B SMO) has its input tuned by A3C5 and its output tuned by A3C8-A3C9, which also function as a capacitive voltage divider for the output signal and match the input impedance

of the following transistor stage A2Q6, of the signal i-f amplifiers subassembly. The LC filter (used in model C SMO) is not tuned externally. The i-f signal output of the i-f mixers subassembly is taken through terminal A of receptacle A3P1, coupled through coaxial cable, and applied through terminal B of receptacle A2P1 at the signal i-f amplifier subassembly.

2.2.4.7 INTERPOLATION OSCILLATOR SUBASSEMBLY. The interpolation oscillator subassembly provides twenty-five 4-kilocycle steps in the frequency band of 549.4 to 645.4 kilocycles. The interpolation oscillator, A5V1, is a pentode in an inductance-tuned Hartley oscillator circuit. The tuned circuit inductance is varied by switching in additional coils in series for a total of twenty-five frequency steps. The frequency of the oscillator changes four kilocycles for each additional series coil that is switched into the circuit. The interpolation oscillator subassembly tuning is mechanically geared to all the other tuned circuits of the 786E-1. The output signal of the interpolation oscillator is coupled through capacitor A5C7 and supplied as two outputs. One output is coupled through resistor A5R7, fed through coaxial cable, and applied to the suppressor grid of the third mixer, A3V2.

2.2.4.8 SIGNAL I-F AMPLIFIER SUBASSEMBLY FOR STABILIZED MASTER OSCILLATOR, MODEL A. In the signal i-f amplifier subassembly, the signal is amplified by four grounded emitter transistor stages in cascade. The i-f signal taken from the secondary winding of A2T3 is applied to the base of the second i-f amplifier, A2Q5, whose collector output is developed across a parallel-tuned circuit consisting of the primary winding of i-f coupling transformer A2T2 and capacitor A2C16. This circuit also is provided with a parallel resistor, A2R12, to increase the bandwidth. A2T2 also is a step-down transformer to match impedance between the collector of A2Q5 and the base of A2Q4. The i-f signal is taken from the secondary winding of A2T2 and impressed on the base of the third i-f amplifier, A2Q4, whose collector output is developed across a parallel-tuned circuit consisting of autotransformer A2L3, capacitor A2C13, and broadbanding resistor A2R8. The signal applied to the base of the fourth i-f amplifier, A2Q3, is taken from a low-impedance tap of A2L3. The collector output of A2Q3 is developed across a parallel-tuned circuit consisting of the primary winding of A2T1 and capacitor A2C9. The d-c feedback is taken from the emitter of A2Q3, coupled through A2R9, and applied to the base circuit of A2Q4 to assist in stabilizing these transistor stages. A2C10 prevents any a-c feedback by coupling any a-c to ground.

The signal taken from the secondary winding of A2T1 is used to derive automatic gain control (agc) voltage for the i-f amplifier stages. Diode A2CR3 rectifies the i-f signal delivered to it, with the resulting voltage appearing across a timing circuit consisting of capacitors A2C11 and A2C25 and bleeder resistors A2R6 and A2R7. The output of this circuit is applied to the base circuits of the first and second i-f amplifiers, A2Q6 and A2Q5, to accomplish agc action. Resistors A2R18 and A2R19 form a bleeder from the +28-volt d-c supply and function as a clamping circuit for the agc line to maintain a positive voltage on the line that determines the conduction level for A2CR4. Capacitor A2C12 is an r-f bypass.

The signal i-f is taken from the collector of the last i-f amplifier, A2Q3, coupled through capacitor A2C7, and applied to junction of two parallel-tuned circuits that are a portion of the phase and frequency discriminator. The characteristics of this disciminator permit it to perform both phase and frequency discriminating action in a single circuit.

Frequency discriminating action of the discriminator occurs in the following manner. The two parallel-tuned circuits, consisting of A2L1-A2C5-A2C26 and A2L2-A2C6-A2C27, are tuned to resonate at frequencies above and below the no-error, 455-kilocycle, i-f signal respectively. The i-f signal is fed in parallel to the two circuits. These circuits must perform two functions by providing nearly constant impedance-matching between the last signal i-f amplifier, A2Q3, and the discriminator circuit, and discriminating action to assist master oscillator frequency correction. To accomplish these two functions, a complementary filter arrangement is used. The filter arrangement also provides a desirable discriminator response curve by preventing the outer frequency skirts from falling off sharply.

Figure 2-1 illustrates the derivation of the complementary filter circuits. Refer to figure 2-1A. Shown in this figure are conventional low- and high-pass filters FL1 and FL2. Immediately below are shown typical response curves for these circuits. A reciprocal law permits these two circuits to have their inputs fed in parallel which causes them to appear as shown in figure 2-1B. This type of connection provides a complementary arrangement in which each filter section furnishes the necessary shunt element for the opposite section. In this manner, the shunt elements shown in figure 2-1A are unnecessary and may be removed. Immediately below the filter circuit in figure 2-1B, typical response curves of the complementary filters are shown on the same plot. Due to back-to-back arrangement of the filters, it is permissible to flip the response of FL1 as shown. The resultant response curve is that of the frequency discriminator. Figure 2-1C shows the addition of CX and LX in parallel with FL1 and FL2 respectively. These components provide tuning of the filters to cause the slope of the composite characteristic to be steeper about the 455-kilocycle crossover frequency which increases discriminator sensitivity.

Refer to figure 2-2. Introduction of a 455-kilocycle signal through A2C7 causes equal conduction in each half of the discriminator during the positive alternation. The resulting currents are rectified by diodes A2CR1 and A2CR2 and flow through the base-to-emitter circuits of A2Q1 and A2Q2 respectively.

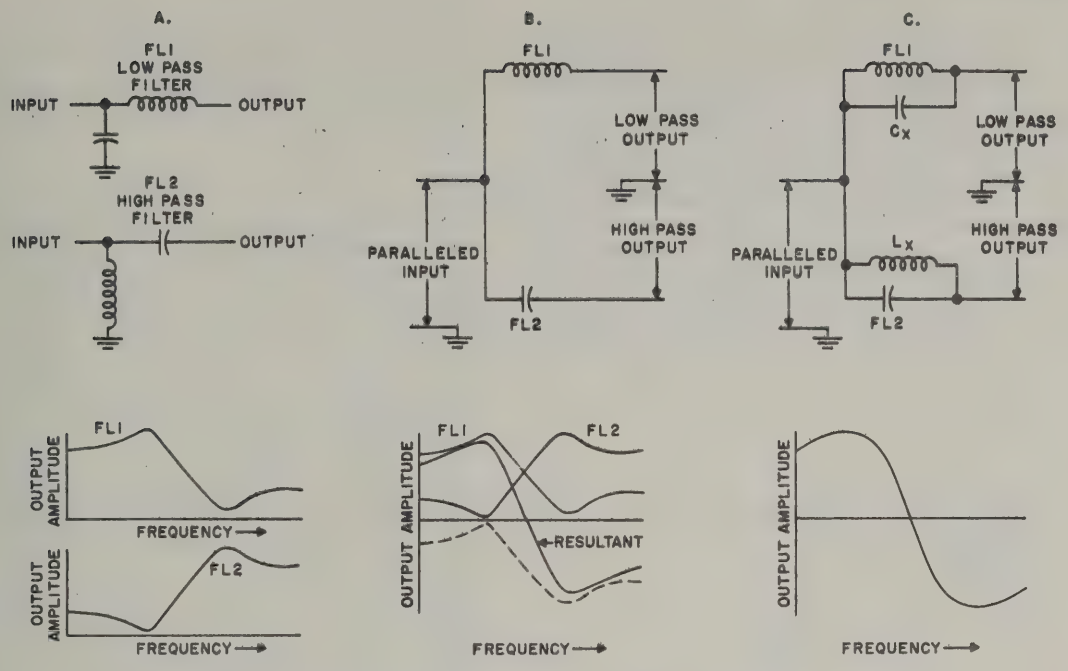


Figure 2-1. Frequency Discriminator, Response Curve Derivation

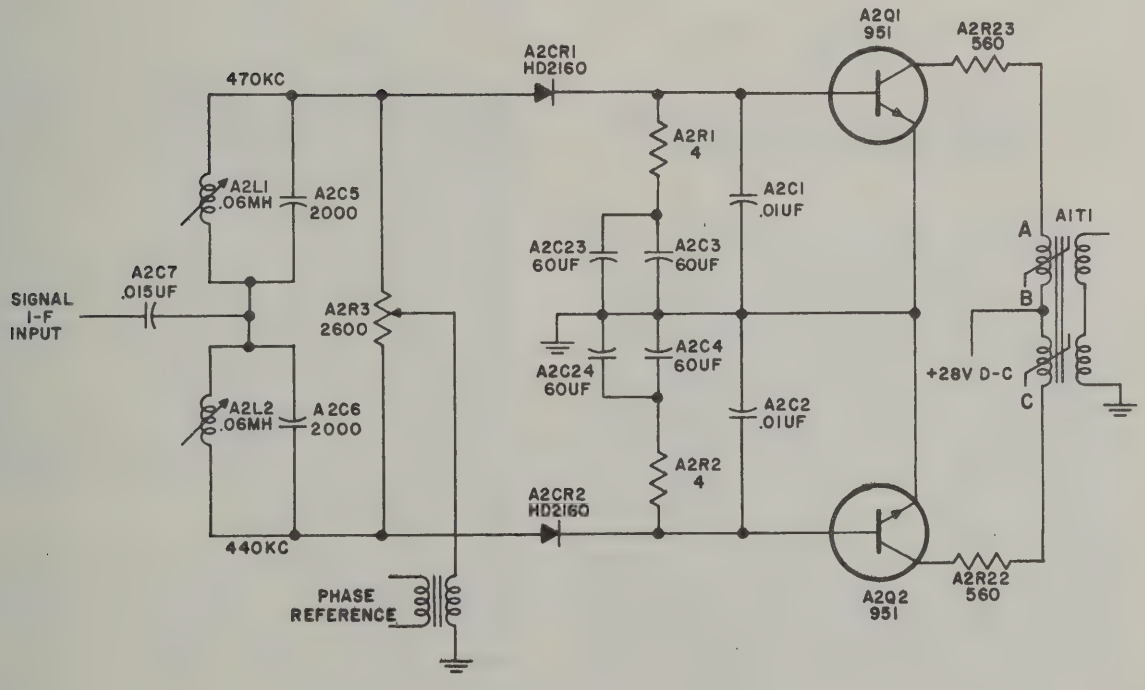


Figure 2-2. Model A Phase and Frequency Discriminator, Simplified Schematic Diagram

The rectified signal causes the bases of A2Q1 and A2Q2 to be driven to some positive value which produces collector output from both. The d-c currents are passed through the center-tapped d-c control winding of saturable reactor A1T1 in a 180-degree relation that causes them to oppose. This causes cancellation of the core flux produced by each in A1T1. In this condition, the discriminator is balanced, and the net control exerted on A1T1 is zero. Figure 2-3 illustrates a representative curve of A1T1 d-c control winding current versus change in master oscillator frequency, where point A indicates the no-error operating point set by permanent magnetic bias of A1T1.

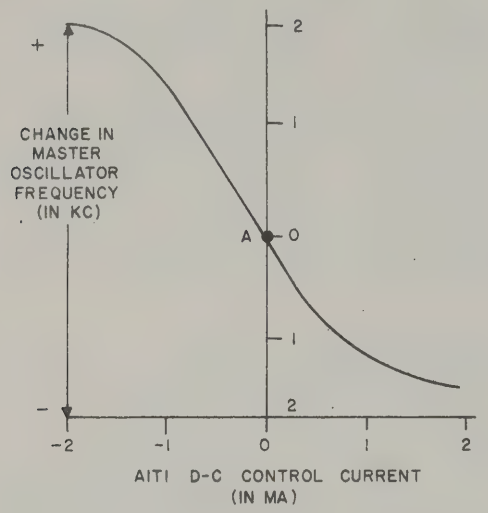


Figure 2-3. Curve of Saturable Reactor Control of Master Oscillator Frequency

An i-f signal containing plus error is passed by the tuned circuit consisting of A2L1 and A2C5. A2CR1 rectifies the signal and applies the positive voltage to the base of A2Q1. The resulting greater current flow through the A to B winding of A1T1 produces a change of net flux in the associated core. This change of flux causes the inductance of the a-c winding to increase, with a resulting decrease of master oscillator frequency. Introduction of an i-f signal containing minus error causes heavier conduction in the other half of the discriminator. The resulting current in the B to C winding of A1T1 produces a net flux that decreases the inductance of A1T1 a-c winding, with a resulting increase of master oscillator frequency. The design of the frequency discriminator is such that it operates from outer limits of about plus or minus 20 kilocycles into inner limits determined by the gain of the stabilizing loop. The outer limits are determined by mechanical filter A3FL2 which has a 40-kilocycle band pass. The inner limits vary, depending on the amount of error, since the stabilizing loop gain is constant. A 2.5-kilocycle master oscillator error multiplied by eight in the SMO to 20 kilocycles will be corrected to about 1.5 kilocycles by frequency discrimination. Frequency correction to less than 1.5 kilocycles could be accomplished for smaller errors but is unnecessary due to initiation of phase discriminating at about 1.5 kilocycles error.

When the error signal has been reduced to less than 1.5 kilocycles, the phase discriminator assumes control of master oscillator frequency correction until frequency error is reduced to within 90° of phase lock. At this point, true phase discrimination occurs, and the master oscillator is phase locked to the Reference Oscillator or standard frequency.

The 455-kilocycle reference phase signal, required to produce phase discriminating, is introduced to the discriminator circuit at the arm of potentiometer A2R3. A simplified diagram of the discriminator is shown in figure 2-2. At the center frequency of 455 kilocycles, the two tuned circuits appear primarily inductive and capacitive as shown in figure 2-1. With this input frequency, FL2 represents the tuned circuit consisting of A2L1, A2C5, and A2C26, (figure 5-7), and FL1 represents the tuned circuit consisting of A2L2, A2C6, and A2C27 (figure 5-7). Refer to figure 2-4. The error signal source is represented by a generator and the total load by resistors R1 and R2.

The inductive and capacitive elements provide a phase-shift network that causes E_{ab} to be approximately 170 degrees out of phase with E_{bc}. The error signal voltage and current are in phase with each other but have about an 85-degree relation to E_{ab} and E_{bc}. In a condition of no-error input, the resultant vector sums of E_{R1} and E_{R2} are of equal amplitude. These voltages cause equal conduction through each half of the discriminator and the load. Since the load contains the d-c windings of A1T1 (figure 2-2), the currents through the windings are equal and produce core fluxes that cancel. Thus no control is exerted on the master oscillator frequency. Figure 2-4A shows the discriminator equivalent circuit, and figure 2-4B shows the voltage vector relationship at balance. Figure 2-4C illustrates the vector relation with positive correction in which E_{R2} is of greater amplitude than E_{R1}. This causes a greater current to flow through the lower winding of A1T1. The current produces a net core flux that causes the inductance of the a-c winding to increase, with a consequent decrease of master oscillator frequency. Figure 2-4D illustrates a reverse situation with negative correction.

The complementary filter arrangement also provides impedance matching of the signal i-f amplifier to the discriminator circuit. Impedance matching is necessary to achieve maximum transfer of power. The output impedance of the last signal i-f amplifier stage is approximately 15,000 ohms. The input impedance of the discriminator is approximately 400 ohms. Figure 2-5 illustrates the impedance matching properties of the complementary filter circuits. The response curves shown are representative plots of filter

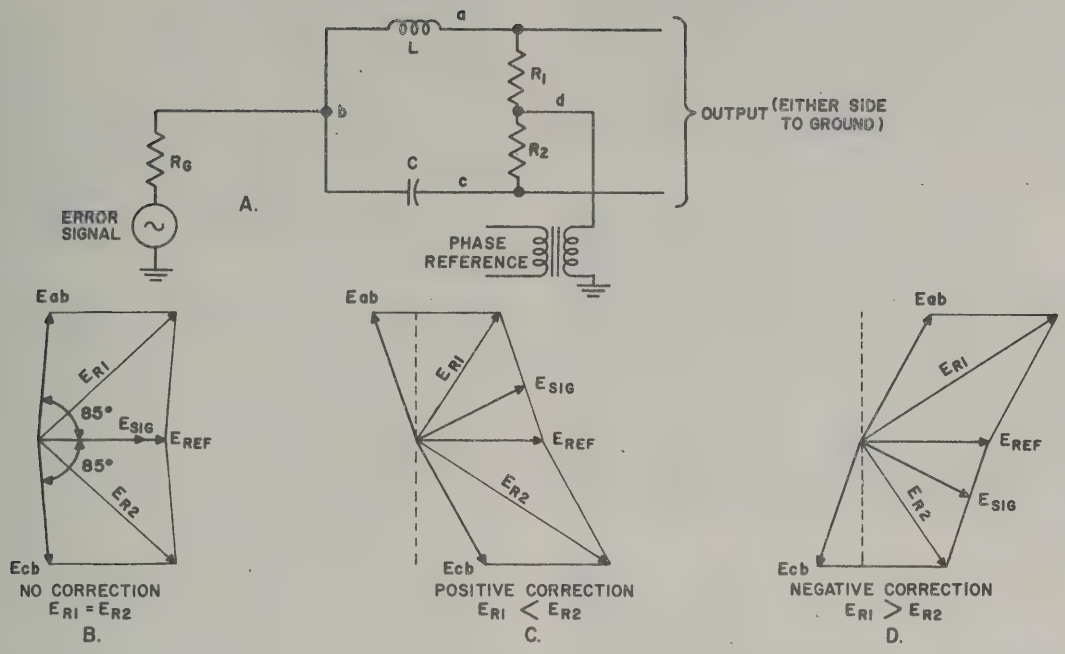


Figure 2-4. Phase and Frequency Discriminator, Equivalent Circuit

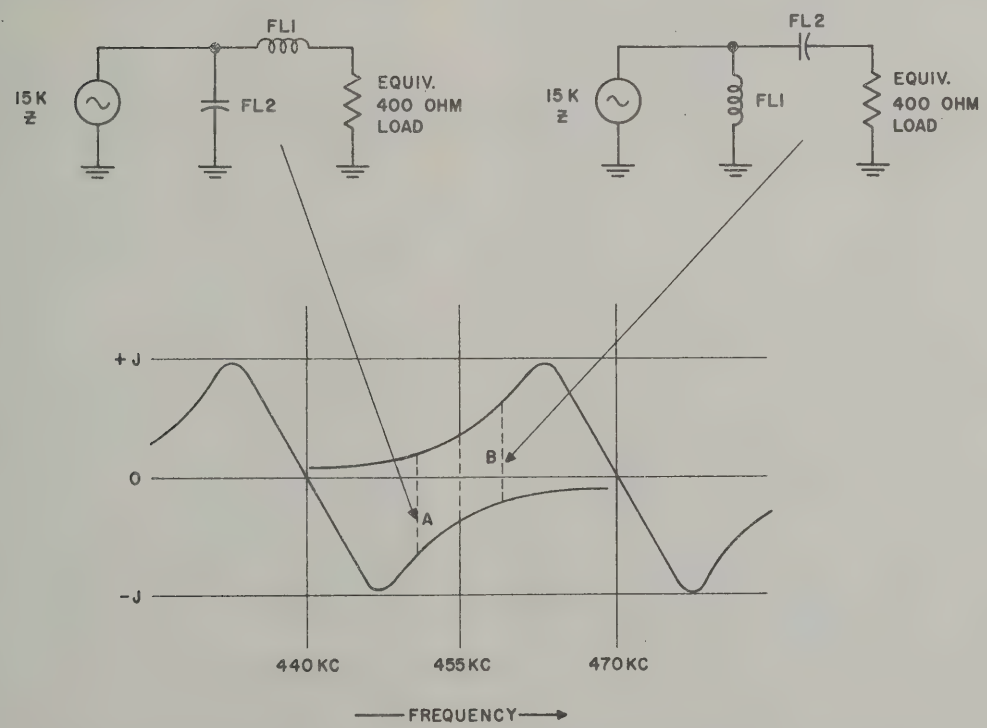


Figure 2-5. Discriminator Tuned Circuits, Frequency Versus Reactance Curves

reactance versus frequency for the two filters. The filter shown for the reactance values at A appears as a pi section that will match the 15,000-ohm generator impedance to the 400-ohm load. The filter shown for the reactance values at B performs identically. These points were chosen to occur at the points of maximum discriminator sensitivity and are variable to permit alignment procedures to obtain the condition just mentioned.

Refer to figure 5-7. Both the master oscillator and signal i-f amplifier subassemblies are provided with heater elements to assist in maintaining temperature stability of the circuits. Heater element A1HR1, in the master oscillator subassembly, maintains the subassembly above +25 degrees C (+77 degrees F). Thermal switch A1S1 decreases the a-c power to A1HR1 when +25 degrees C is attained. The heater element located on the signal i-f printed circuit card is wound around a compartment which contains the temperature-sensitive components of the phase and frequency discriminator. These components include the tuned circuits, diodes, transistors, and the thermal switch.

The agc circuit of the signal i-f amplifier is controlled in several ways. The agc line is shorted to ground when the TUNE-OPERATE switch on the front panel is depressed after the frequency has been selected. During the manual frequency selection, the discriminator can readily lock on an undesired spurious signal. It is necessary, therefore, to recycle the signal i-f amplifier, the discriminator, and the agc circuits by grounding them after tuning is complete. The time delay of A2C11 and A5C25 charging through A2R6, after agc ground is removed, prevents the discriminator from locking on frequency until the signal i-f amplifier builds up the i-f signal. Grounding of the agc line also grounds the base circuits of the first and second signal i-f amplifiers, A2Q6 and A2Q5, which prevents them from conducting since they require about +0.3 volt or more on their bases to cause them to conduct. Recharging of the agc filter is not completed until shortly after removing the agc ground at which time the agc turns on the i-f amplifiers. Disabling the i-f amplifiers prevents the discriminator from following the mechanical tuning cycle which could prevent the desired electronic positioning and phase lock of the master oscillator frequency. When no signal is present in the signal i-f amplifier subassembly, the agc line is maintained at about +0.3 volt positive by voltage divider A2R18-A2R19 to maintain A2Q6 and A2Q5 in an operating condition. When a signal is introduced to the signal i-f subassembly, the agc voltage derived controls A2Q5 and A2Q6 conduction. The agc line is clamped by diode A2CR4 to prevent the bases of A2Q5 and A2Q6 from going more than +0.9 volt positive which would damage the transistors. A second delay circuit consisting of A2R4, A2R5, and A2C8 is used to vary the bias on the agc diode A2CR3 to promote agc voltage that will control the drive to the discriminator circuit and, consequently, to A2Q1 and A2Q2. This function is performed in the following manner. When A2Q1 and A2Q2 are subjected to temperature rise, their characteristics cause them to conduct heavier with the same amount of input signal. Consequently, the increased collector current causes a decrease in collector voltage which appears across voltage divider A2R4 and A2R5. The decrease in voltage appears at the cathode of A2CR3 permitting it to conduct earlier. This reduces the drive to the signal i-f amplifier input which reduces the drive to the discriminator circuit. This provision prevents A2Q1 and A2Q2 from being damaged by excessive current. A2C8 in the delay circuit functions as an r-f bypass to prevent r-f from feeding onto the agc line.

2.2.4.9 SIGNAL I-F AMPLIFIER FOR STABILIZED MASTER OSCILLATOR, MODEL B AND MODEL C. Refer to figure 5-8 or 5-9 for schematic diagram. The i-f signal is taken from the output tank circuit of i-f amplifier, A2Q3, and is coupled through capacitors A2C32 and A2C33 to the two parallel-tuned tank circuits of the frequency discriminator.

The tank circuit consisting of A2L1, A2C25, and A2C26 is tuned to resonate at frequencies above the no-error 455-kilocycle i-f signal, and the tank circuit consisting of A2L2, A2C6, and A2C27 is tuned to resonate at frequencies below the no-error 455-kilocycle i-f signal. These tank circuits perform dual functions by providing nearly constant impedance matching between A2Q3 output tank circuit and the frequency discriminator circuit, and by providing discriminating action to assist master oscillator frequency correction. The tank circuits of the discriminator are connected in a complementary filter arrangement, which also provides a desirable discriminator response curve.

Resistors A2R25, A2R26, A2R27, A2R28, A2R29, A2R30, and A2R31 form a voltage divider network for the voltage variable capacitor, A1C11. This network is maintained at a constant d-c potential (+16 volts d-c at pin E of A2P1) from the +28-volt d-c supply by Zener diode A1CR1. The action of the frequency and phase discriminator is to add or subtract voltages from the steady-state regulated supply voltage applied to the voltage-variable capacitor, AC11, located in the grid tuning circuit of the master oscillator. The capacitance of A1C11 varies as follows: An increase in voltage decreases capacitance, a decrease in voltage increases capacitance. Introduction of a 455-kilocycle signal to the tank circuits of the discriminator causes equal conduction in each half of the discriminator during the positive alternation. The resulting currents are rectified by diodes A2CR1 and A2CR2 and flow through resistors A2R25 and A2R26 respectively. The d-c currents through these resistors are equal and 180 degrees out of phase, therefore, no voltage change occurs at voltage variable capacitor A1C11. In this condition the discriminator is balanced and the net control exerted on A1C11 is zero.

An i-f signal containing error that places it below 455.0 kilocycles is passed by the tuned circuit consisting of A2L2, A2C6, and A2C27. A2CR2 rectifies the signal which results in a decrease in voltage at

A1C11. The decrease in voltage increases the capacitance of A1C11 with a resultant decrease in master oscillator frequency. Introduction of an i-f signal containing error that places it above 455.0 kilocycles causes heavier conduction in the other half of the discriminator resulting in an increase in voltage at A1C11. The increase in voltage decreases the capacitance of A1C11 with a resultant increase in master oscillator frequency. The frequency discriminator operates from outer limits of about plus or minus 20.0 kilocycles into inner limits determined by the gain of the stabilized loop. The outer limits are determined by mechanical filter A3FL2 in the i-f mixers subassembly which has a 40-kilocycle band pass. The inner limits vary depending on the amount of error since the stabilizing loop gain is constant. A master oscillator error multiplied to 20.0 kilocycles will be corrected to about 1.5 kilocycles by frequency discrimination. Frequency correction of less than 1.5 kilocycles could be accomplished for smaller error but is unnecessary due to initiation of phase discriminating at about 2.2 kilocycles error. Resistor A2R27 isolates and couples the frequency and phase discriminator outputs.

When the error signal is less than 2.2 kilocycles, the phase discriminator assumes control of master oscillator correction. The i-f error signal, consisting of 455.0 kilocycles plus or minus the 2.2-kilocycle error, is beat with a 455.0-kilocycle reference to obtain a 2.2-kilocycle audio beat note. The audio beat note causes the control voltage of voltage variable capacitor A1C11 to vary at an audio rate which causes the capacitance of A1C11 to change at an audio rate. This action causes the master oscillator to be frequency modulated. The frequency-modulated master oscillator frequency then is fed through the stabilizing loop. When the polarity of the beat note signal is in a direction that reduces the original error, the beat frequency is lower and has a longer half cycle. When the beat note polarity reverses, the beat frequency is higher and the length of the half-cycle is shorter. This distortion of the audio beat note causes it to have a d-c average that causes discriminator action to pull the master oscillator frequency toward no error. As the beat note decreases in frequency, the periods of half-cycle time become longer, and the d-c average becomes greater. This action causes the master oscillator frequency to be corrected even more. When the master oscillator frequency is pulled within 90.0 degrees of the reference, the phase discriminator circuit phase locks and provides an error signal that will correct and maintain the master oscillator to the corrected frequency. See figure 2-6A. The 455-kilocycle reference phase signal required to produce phase discriminating is introduced at the primary of A2T4. The i-f signal is introduced at the center tap of A2T4 secondary. Introduction of a no-error 455-kilocycle signal at A2T4 secondary causes A2CR5 and A2CR6 to conduct equally through resistors A2R28 and A2R29 respectively. The d-c current through these resistors is equal and 180 degrees out of phase; therefore, no voltage change occurs at voltage variable capacitor A1C11. Thus, no control is exerted on the master oscillator frequency. A 455-kilocycle i-f error signal voltage with a phase relative to the reference signal components as shown in figure 2-6C will cause A2CR5 to conduct heavier which results in an increase in voltage at A1C11 with a resultant increase in master oscillator frequency. An i-f signal voltage with phase position as shown in figure 2-6D will cause A2CR6 to conduct more and result in a decrease in voltage at A1C11 with a resultant decrease in master oscillator frequency.

Summing the frequency and phase discriminating action, assume a master oscillator error of 2.5 kilocycles. When multiplied, this error becomes 20.0 kilocycles at the discriminator. Frequency discriminating characteristics will cause derivation of d-c control voltage for A1C11 that will cause the master oscillator error to be corrected to less than 2.0 kilocycles. Phase discriminating action then is initiated to derive the audio beat note that is used to frequency modulate the master oscillator. This correction will pull master oscillator to within 90 degrees of the reference at which time the phase discriminator corrects master oscillator error and maintains it in phase lock.

2.2.4.10 FOUR-KILOCYCLE SPECTRUM GENERATOR SUBASSEMBLY. A four-kilocycle signal from the Frequency Divider module is delivered to the SMO through terminal 34 of receptacle P1 and coupled through coaxial cable to terminal A of receptacle A6P1 of the 4-kilocycle spectrum generator subassembly. The four-kilocycle signal is coupled through capacitor A6C1 and applied to a monostable transistorized multivibrator, A6Q1 and A6Q2. With no signal input, normally A6Q1 is cut off while A6Q2 is conducting. Transistor A6Q2 is connected across the collector tank circuit of a transistor oscillator, A6Q3, loading the tank and preventing the oscillator from operating. Oscillator A6Q3 functions as a tuned-collector, inductance-coupled oscillator using heavy feedback to promote fast starting and stopping. Transistor A6Q3 produces an output of 1050 kilocycles when permitted to oscillate. The introduction of the four-kilocycle sine wave signal to the base of A6Q1 drives it into conduction causing A6Q2 to cut off. The pulse generator operates only on positive alternations of the input signal due to clamping diode A6CR1 in the base circuit of A6Q1. The pulse generator produces narrow pulses in the output due to the small time constant of the time-determining elements A6C3 and A6R5 and the base resistance of A6Q2. Whenever A6Q2 is cut off, it unloads the tank circuit of A6Q3 permitting it to oscillate for the duration of the pulse applied to the pulse generator. This time is selected to permit an output of about eight cycles. The eight-cycle output spectrum, centered at 1050 kilocycles, appears across the collector tank circuit of A6Q3. This signal is applied to filter A6FL1, which has a band pass of 1000 to 1100 kilocycles, to pass 25 four-kilocycle spectrum points centered around the oscillator frequency of 1050 kilocycles. The output of A6FL1 is applied to the control grid of the fourth mixer, A6V1. The mixing signal for A6V1 is supplied by the interpolation

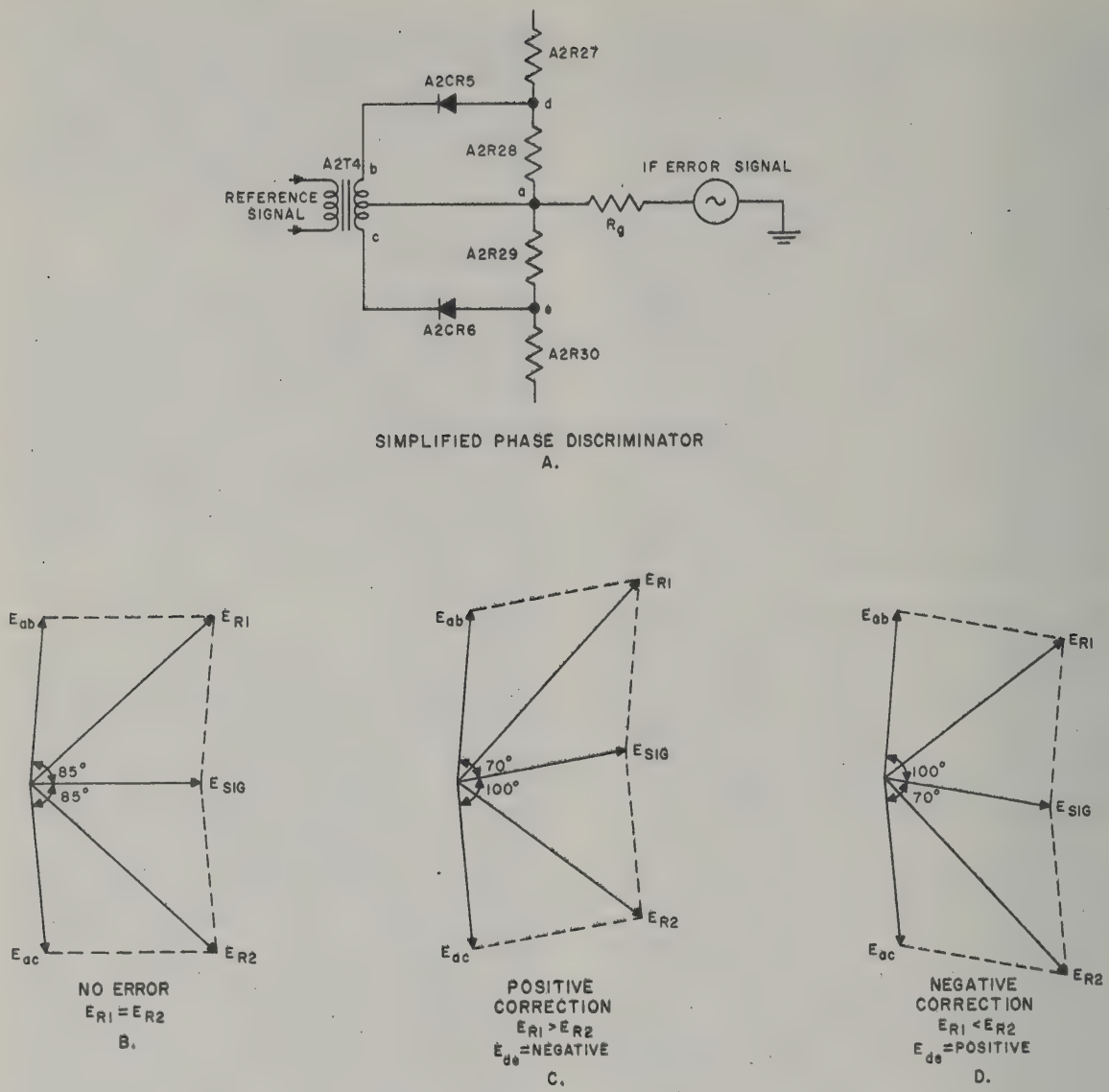


Figure 2-6. Model B Phase Discriminator, Vector Diagram

oscillator. The frequency supplied by the interpolation oscillator is the same as the injection it supplies to the third mixer in the i-f mixers subassembly. The interpolation oscillator signal is introduced into the 4-kilocycle spectrum generator subassembly through terminal F of receptacle A6P1 and applied to the suppressor grid of fourth mixer A6V1. Mixing of the four-kilocycle spectrum signal and the interpolation oscillator injection signal produces sum and difference frequencies in the plate output. The usable output is determined by a mechanical filter located in the reference i-f amplifier subassembly.

2.2.4.11 REFERENCE I-F AMPLIFIER SUBASSEMBLY. The spectrum output of the 4-kc spectrum generator subassembly is taken from terminal K of A6P1, coupled through coaxial cable, and applied to terminal B of receptacle A7P1 of the reference i-f amplifier subassembly. The signal then is applied to the tuned input of mechanical filter A7FL1. Filter A7FL1 is a 455-kilocycle filter with a two-kilocycle band-pass characteristic that rejects all four-kilocycle spectrum points and the interpolation oscillator frequency, but passes the 455-kilocycle difference frequency of the interpolation oscillator frequency and

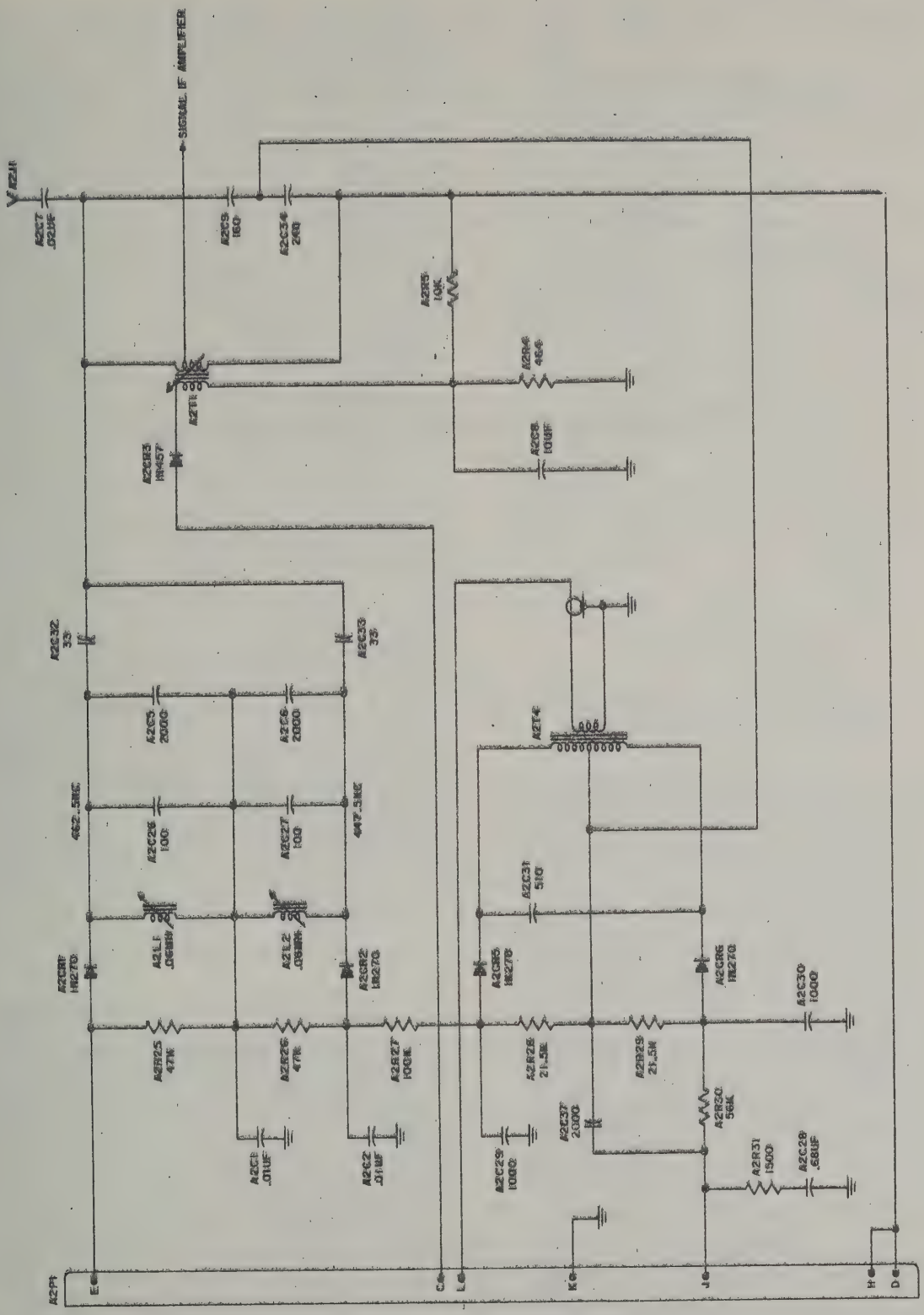


Figure 2-7. Model B and Model C Phase and Frequency Discriminator, Simplified Schematic

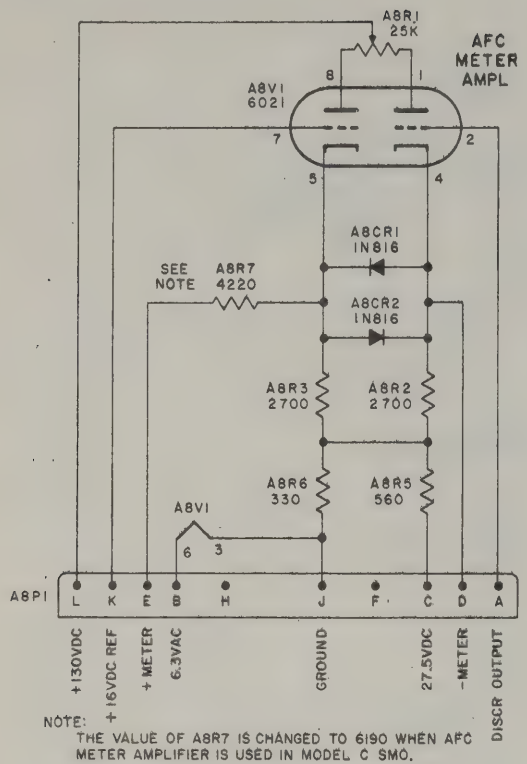


Figure 2-8. AFC Meter Amplifier, Simplified Schematic Diagram

one of the four-kilocycle spectrum points. The output of A7FL1 is connected across series capacitors A7C2 and A7C3 which provides tuning of the A7FL1 output while providing impedance matching between the filter and the base circuit of the first i-f amplifier. The i-f amplifier consists of three cascaded transistor stages one of which is agc controlled. The 455-kilocycle signal applied to the base of A7Q1 is amplified and applied to a tuned circuit consisting of A7C5 in parallel with the variable primary of i-f coupling transformer A7T1. Transformer A7T1 is a step-down transformer which provides coupling of the i-f signal and impedance matching of the collector circuit of A7Q1 to the base circuit of A7Q2. The collector output of A7Q2 is developed across a tuned autotransformer A7L2. Output is taken from a tap and applied to the base of A7Q3. The d-c feedback is taken from the emitter of A7Q3 and delivered to the base of A7Q2 through A7R5 for bias stabilization. The collector output of A7Q3 is developed across the tuned primary of A7T2. One of the two secondary windings of A7T2 couples the 455-kilocycle reference i-f signal to terminal K of receptacle A7P1, and the other couples a portion of the signal to the agc circuit. The agc circuit is very similar to the one used in the signal i-f amplifier subassembly. Diode A7CR2 provides rectification of the signal during negative alternations and is provided with a delay circuit consisting of A7C7 and A7R12. Resistors A7R12 and A7R9 serve as a voltage divider from the +28-volt d-c supply to obtain +0.8 volt on the agc line with no signal input. Resistors A7R10 and A7R11 form a voltage divider to provide agc delay voltage. Resistors A7R3 and A7R8 form a bleeder to set the conduction time of A7CR1 which provides a clamp on the agc line to prevent it from going positive except for small amounts (+0.9 volt maximum). The 455-kilocycle i-f output taken from terminal K of receptacle A7P1 is coupled through coaxial cable and applied to the signal i-f amplifier subassembly through terminal L of receptacle A2P1 for use as the reference of the phase and frequency discriminator.

2.2.4.12 AFC METER AMPLIFIER. An AFC meter amplifier is used in the model B and model C Stabilized Master Oscillator modules. It is necessary to isolate the low-impedance meter from the high-impedance discriminator output with an amplifier in order to obtain the necessary gain to operate the AFC meter. The AFC meter amplifier is a cathode follower circuit consisting of a dual triode, A8V1. (See schematic diagram, figure 2-8.) Variable resistor A8R1 is used to balance the two halves of the tube A8V1. The tube is balanced when the AFC meter reads zero with no drive from the discriminator. Resistors A8R2 and A8R3 are the cathode resistors. Resistors A8R5 and A8R6 are used as voltage dividers across the 27.5 volt line. This will put the tube A8V1 plus 16 volts above ground which is necessary to overcome the plus 16 volts that is applied to the grid (pin 7) of A8V1. The drive from the discriminator will cause the bias to the grid of the tube to increase or decrease, causing current to flow. This is indicated on the AFC meter. Resistor A8R7 is a multiplying resistor for the meter. The model C SMO has a larger pull-in range which causes more current to flow through the AFC meter making it read off scale. To prevent this off-scale reading, multiplying resistor A8R7 is changed to a larger value. Diodes A8CR1 and A8CR2 are used to prevent excessive overload current from damaging the meter. The diodes will let the meter pin but will not let it go beyond that point.

2.2.5 SIDESTEP OSCILLATOR MODULE.

The schematic diagram of the Sidestep Oscillator is shown in figure 5-6. The 2.4-megacycle signal from the Reference Oscillator and the 1-kilocycle signal from the Frequency Divider are coupled into the Sidestep Oscillator module through terminals D and A of P1 respectively. The 1-kilocycle signal is applied to a monostable multivibrator, Q1 and Q2. This stage functions as a pulse generator and produces a 1-kilocycle pulse that is coupled to the control grid of mixer V1 and keys V1 into conduction at a 1-kilocycle rate. This action causes the 2.4-megacycle signal on the suppressor grid to have a 1-kilocycle spectrum impressed upon it. Mixer V1 requires another input for mixing to provide a usable output. This input signal is supplied by a crystal-controlled oscillator, V2. Four relay-selected crystals, in the control grid circuit of V2, determine the operating frequency of the oscillator. The crystals are selected, one at a

time, by relays K1 and K2 which are operated automatically when a frequency selection change is made at the front panel with the FREQUENCY CHANGE and BAND - ADD KC controls. The four operating frequencies available from the oscillator are 1.945, 1.944, 1.943, and 1.942 megacycles. The 1.945-megacycle crystal is not used in all radio set configurations, since sidestep oscillator bypass relay K1 (on Frequency Generator 786E-1 chassis) allows the Reference Oscillator module signal of 2.4 megacycles to be fed directly to the SMO module. The plate output of V2 is coupled through capacitor C13 and applied to the suppressor grid of the first mixer, V1. The 2.4-megacycle signal containing the 1-kilocycle spectrum is beat with the oscillator signal to produce a difference frequency of 455 kilocycles. This signal is passed through a 455-kilocycle mechanical filter, FL1, which has a band pass of 200 cycles per second. The filter rejects the oscillator signal, the 2.4-megacycle signal, and adjacent spectrum signals which are 1 kilocycle above or below the desired signal, but will pass any oscillator errors that fall within the pass band of FL1. The 455-kilocycle signal, plus or minus the oscillator error, is applied to the control grid, lead 1, of amplifier V3 whose amplified output is tuned by the circuit consisting of C21, C22, and the primary winding of transformer T1. The signal from the secondary winding of T1 is impressed on the control grid of mixer, V4. Also coupled to the second mixer stage is a signal from the cathode of oscillator V2. This signal is the same frequency as the oscillator plate output used at the first mixer V1. This signal is coupled through capacitor C24 and applied to the suppressor grid of mixer V4. The parallel-tuned circuit consisting of L2 and C25 is tuned to the output of crystal oscillator V2. Any frequency drift that may be present in the 455-kilocycle signal on the control grid of V4 is also present in the oscillator signal at the suppressor grid. The two signals are mixed in the electron stream of V4, and the sum frequency taken from the plate appears across the parallel-tuned circuit consisting of the primary winding of transformer T2 and capacitor C26. The output signal is taken from the secondary winding of T2 and applied to terminals A and B of receptacle P2 for use as on input to the SMO module.

2.2.6 FREQUENCY DIVIDER MODULE.

2.2.6.1 INPUT AMPLIFIER. The 100-kilocycle signal from the Reference Oscillator module is coupled from connector P1-A through capacitor C1 to the base of the input amplifier, Q1. The base of Q1 is positively biased by the voltage divider consisting of R1 and CR1 from B+ to ground. Diode CR1 is polarized to present a high backward resistance as part of the voltage divider. This presents a high impedance to ground for positive half-cycles of 100-kilocycle signal and low impedance to ground for negative half-cycles of 100-kilocycle signal, resulting in square-wave, positive half-cycle input to the base of amplifier Q1. The square-wave output of Q1 is applied across resistor R2 and the primary winding of T1 (in series) and is differentiated to a spiked waveform. Resistor R18 loads the primary winding of T1 and limits the peak voltage swing across it.

2.2.6.2 TWENTY-KILOCYCLE DIVIDER. Refer to figures 2-9 and 2-10. Transistors Q2 and Q3 are connected in a free-running multivibrator circuit. The two secondary windings of transformer T1 are oriented so that the spike obtained across the primary is added to the base potentials of Q2 and Q3. The total capacitor discharging times of the two RC circuits in the base connections to the two transistors are different. The discharge time can be called the free-running time and is related to the RC product approximately by: Period = 2/3 RC. The period determined by R4 and C2 in the base lead of Q2 is about 35 microseconds, and that of R5 and C3 in the base of Q3 is about 25 microseconds. The 100-kilocycle input produces 10-microsecond triggering pulses that are coupled through T1 to the bases of Q2 and Q3 where they become superimposed upon the discharging voltage. The shape of the discharging voltage curve permits one of the 10-microsecond pulses to cause a transistor to begin conducting collector current before the 35- (or 25-) microsecond period has actually been completed. Thus the 10-microsecond pulses lock Q2 to a 30-microsecond "off" period and a 20-microsecond "on" period. This produces a total cyclic period of 50 microseconds for the multivibrator Q2 and Q3 which produces a 20-kilocycle output frequency. Diodes CR3 and CR4 prevent emitter breakdown.

Refer to figure 2-10. Assuming that Q2 fires first, the drop in collector voltage is translated to the base of Q3. When Q2 collector voltage has reached minimum, capacitor C3 begins to discharge at a rate determined by the product of R5 and C3 causing Q3 base voltage to rise. The total time required for this voltage to rise high enough to bias Q3 into conduction is 25 microseconds. The 100-kilocycle pulses appear every 10 microseconds as spikes superimposed upon the rising voltage at point A. Figure 2-10 represents the oscilloscope pattern of the triggering voltage at point A of figure 2-9. Since the amplitude of the 100-kilocycle pulses is great enough to exceed the critical base bias voltage of Q3 five microseconds before the 25-microsecond discharge time has elapsed, Q3 will conduct 20 microseconds after Q2. The Q3 collector voltage drop is transferred to the base of Q2, immediately cutting off conduction of Q2. The third 10-microsecond locking pulse on the discharging voltage at point B (figure 2-10B) triggers Q3 back into conduction five microseconds before the 35-microsecond RC time has elapsed. This arrangement allows Q2 to conduct for 20 microseconds and Q3 to conduct for 30 microseconds, providing a total period of 50 microseconds for the multivibrator producing 20-kilocycle output to the primary of transformer T2.

2.2.6.3 FOUR-KILOCYCLE DIVIDER. Transistors Q4 and Q5 are connected in a free-running multivibrator circuit similar to that of Q2 and Q3. The 20-kilocycle square-wave signal from the collector of Q3 is applied across R6 and the primary of T2 (in series) where it is differentiated to a spiked waveform having

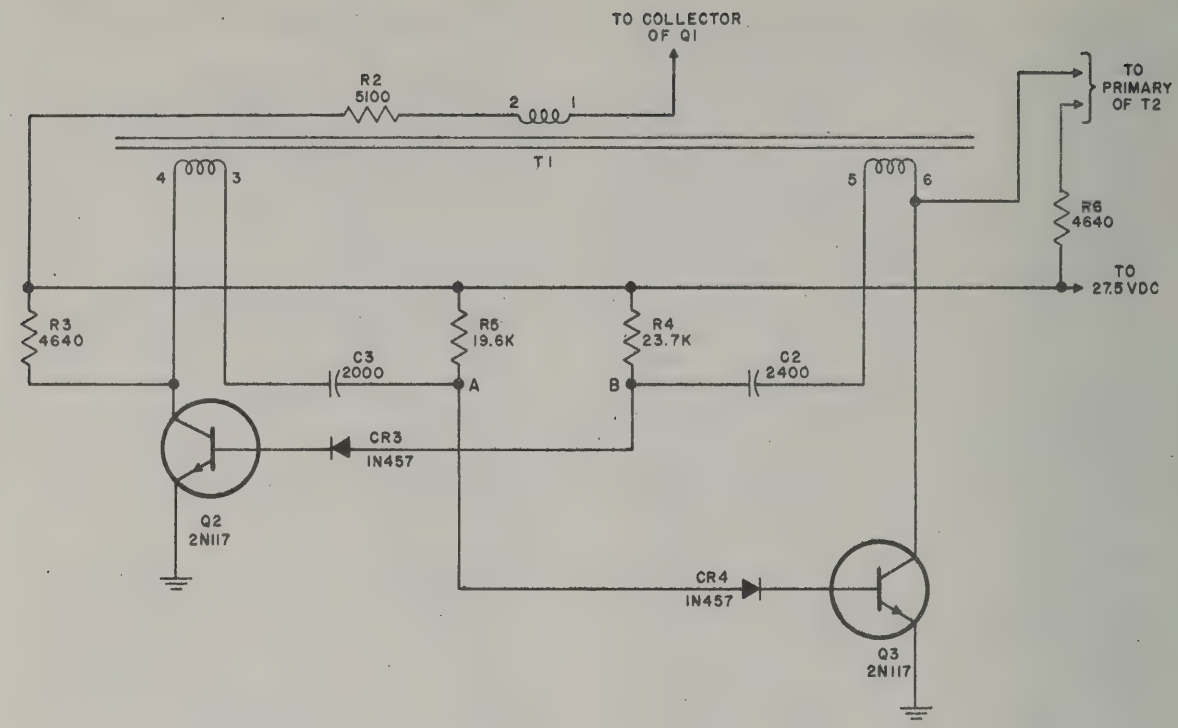


Figure 2-9. Twenty-Kilocycle Divider, Simplified Schematic Diagram

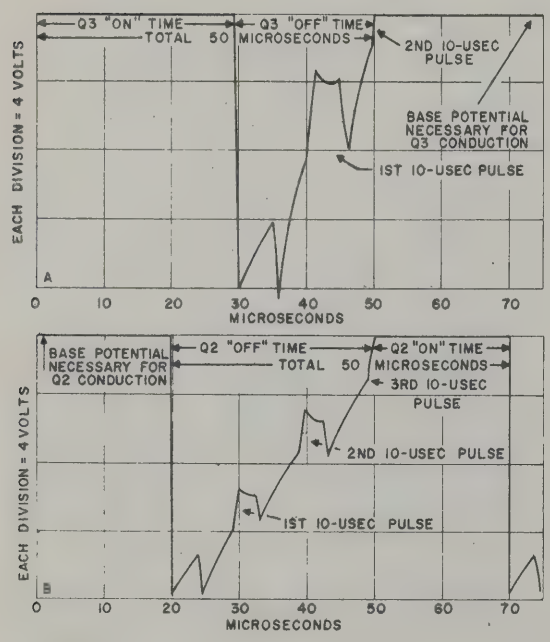


Figure 2-10. Twenty-Kilocycle Divider Base Voltage Waveforms

a period of 50 microseconds between pulses. The dividing action is accomplished in the same manner as in the 20-kilocycle multivibrator. The period in the base circuit of Q4 (determined by R8 and C4, see figure 5-5) is 175 microseconds. The 50-microsecond triggering pulses (from the 20-kilocycle input) lock Q4 to a 150-microsecond off time. The period in the base circuit of Q5 (determined by R9 and C5) is 125 microseconds. The 50-microsecond triggering pulses lock Q5 to a 100-microsecond off time. The total time period of the multivibrator is 250 microseconds, and the output frequency produced is four kilocycles. The four-kilocycle output is taken from the Q5 collector, filtered and integrated by resistor R11 and capacitor C6, then coupled through capacitor C7 as an output to the Stabilized Master Oscillator module.

2.2.6.4 ONE-KILOCYCLE DIVIDER. The action of the one-kilocycle divider is exactly like that of the 20-kilocycle and four-kilocycle dividers except that the two base circuit time constants are equal because the frequency is being divided by an even number. The free-running time period for both Q6 and Q7 is 625 microseconds. The four-kilocycle input from the four-kilocycle divider produces triggering pulses of 250 microseconds that lock Q6 and Q7 at 500 microseconds each. The total cyclic period for the Q7-Q6 multivibrator is 1000 microseconds, producing a one-kilocycle square-wave output. This output is filtered

and integrated by resistor R16 and capacitor C12 and coupled through capacitor C13 to pin P1-H, where it is used as an input to the Sidestep Oscillator module. The Frequency Divider module is isolated from the power supply and any other associated equipment by a filter consisting of inductor L1; resistor R17; and capacitors C14, C15, and C16. Test jacks J1, J2, and J3 are accessible at the top of the module when it is mounted on the chassis.

2.2.7 REFERENCE OSCILLATOR MODULE.

2.2.7.1 CRYSTAL OSCILLATOR AND REGENERATIVE DIVIDERS. Figure 5-4 is the schematic of Reference Oscillator. The crystal-controlled oscillator circuit uses a 3.0-megacycle quartz crystal, Y1. A series-tuned circuit, consisting of a variable, inductance-tuned coil, L1, and capacitor C3, is provided to permit fine tuning adjustment of the oscillator to compensate for aging effects. Transistor Q5 is an oscillator with feedback from the collector through the 3.0-megacycle crystal to the base. Variable inductor L1 permits calibration adjustments. Output from the collector-tuned circuit, L2 and C5, is coupled through capacitor C6 to the base of the 3.0-megacycle buffer, Q6. Untuned collector output from the buffer is coupled through capacitor C8 to the emitter of the 600-kilocycle mixer, Q7. The 600-kilocycle output from the Q7 collector-tuned circuit is connected to the base of multiplier Q10, the collector circuit of which is tuned to 2.4 megacycles by L5, C24, C25, and C26. The 2.4-megacycle output from the top of capacitive divider (C24 and C25) is connected back to the base of mixer Q7 where it is mixed with 3.0 megacycles to produce a 600-kilocycle frequency in Q7 collector circuit. A portion of the 2.4-megacycle output from the collector circuit of Q10 is coupled through capacitor C31 to the base of the 2.4-megacycle output amplifier, Q12. The untuned output from the collector of Q12 is coupled through capacitor C33 to receptacle P1-D for delivery to the Sidestep Oscillator module and the stabilized master oscillator module. The output from the collector circuit of mixer Q7 is coupled through capacitor C12 to the base of the 600-kilocycle buffer, Q8. The untuned 600-kilocycle output from Q8 collector is coupled through capacitor C14 to the emitter of 100-kilocycle mixer Q9. The collector of Q9 is tuned to 100 kilocycles by L4, C15, C16, and C17. The 100-kilocycle output from the capacitive divider, C15 and C16, of Q9 collector circuit is connected to the base of multiplier Q11. The collector of Q11 is tuned to 500 kilocycles by inductor L6, variable capacitor C30, and capacitive divider C28 and C29. The 500-kilocycle output from the junction of the capacitive divider in Q11 collector circuit is connected to the base of 100-kilocycle mixer Q9. The 600-kilocycle and 500-kilocycle signals are mixed in Q9 to produce the 100-kilocycle signal in Q9 collector tank circuit. The 100-kilocycle output from Q9 collector circuit is coupled through capacitor C34 to the base of 100-kilocycle output amplifier Q13. The collector circuit of Q13 is tuned to 100 kilocycles by L7, C36, C37, and C38. The output from this tuned circuit is connected to pin F of receptacle P1 for delivery to the Frequency Divider and the SMO modules of Frequency Generator 786E-1 and to the sideband generator. Dividing action is started in both regenerative divider loops by electrical noise in the tuned circuits of the loops.

2.2.7.2 OVEN CONTROL CIRCUIT. Since the frequency accuracy of the equipment depends on the stability of the Reference Oscillator, an oven circuit is employed to stabilize the crystal of the oscillator against ambient temperatures. The crystal, Y1, and a heater, HR1, are closed in an insulated envelope for ambient thermal isolation. This unit is temperature controlled at +80 degrees centigrade (176°F) by a proportional feedback circuit consisting of the heater and a transistorized audio amplifier tuned to approximately 5 kilocycles. The oven heater is a Wheatstone bridge in which two of the bridge arms are composed of nickel wire, and the other two bridge arms are made of a low-temperature coefficient alloy. The oven heater acts as both heater and temperature sensing element. When the bridge is balanced, the resistance of the bridge arms is equal. This condition is predetermined to occur at +80°C. When the bridge is below balance temperature, there is a positive feedback around the audio amplifier loop, and power is applied to the heater arms of the bridge. As the bridge heats, it comes closer to balance until the attenuation of the bridge is equal to the gain of the amplifier; thus, unity loop gain is achieved, and the temperature is only a few hundredths of a degree below bridge balance temperature.

The oven control amplifier is transistorized and consists of an input amplifier Q3, a driver amplifier Q1, and a push-pull, class B power amplifier (Q2 and Q4). This combination delivers about 12 watts to the heater during warmup. When the bridge circuit is subjected to a temperature change, the resistance of the bridge arms changes, causing an unbalance condition. Under this condition, an error signal is derived from the voltage divider action of the bridge and applied to the base of voltage amplifier Q3. The output of Q3 is taken from the collector, coupled through transformer T2 (which is tuned to approximately 5 kilocycles by C2), and applied to the base of driver amplifier Q1. The collector output of Q1 is applied to transformer T1 which drives the push-pull power amplifier stage, Q2 and Q4. The output power of the power amplifier stage is taken from transformer T3 and applied across the heater bridge circuit causing it to raise the oven temperature which returns the bridge to balance condition. A temperature-controlled avc bias is supplied to Q3 through R20-C18 so that amplifier saturation is reached at relatively small power outputs during periods of high ambient temperature. Protective device CB1 provides additional bias when the transistor temperature rises above 65 degrees C (149 degrees F). This provision prevents transistors Q2 and Q4 from being damaged by excessive leakage current. The +28.0-volt d-c transistor supply return is isolated from the reference oscillator chassis to prevent the 5-kilocycle frequency

of the heater loop from coupling into any of the Reference Oscillator output frequencies.

A number of modifications have been incorporated into the Reference Oscillator module, and not all modules in the field are necessarily the same. All models are interchangeable, however, as the modifications are internal. Some of the more important modifications will be discussed here. All modifications are listed on the schematic diagram of the Reference Oscillator, figure 5-4. MOD J consists of three changes. A Zener diode CR3 has been added to regulate the transistor bias supply to the frequency dividers (to +21 volts), and R29 has been changed in value. These changes eliminate an unstable condition at high temperatures and high supply voltages. Resistor R40 has been added across inductor L6 to lower the Q of the coil. This change provides more divider bandwidth and improves performance at temperature extremes. MOD G consists of limiting diodes CR1 and CR2 across the oven bridge circuit. These diodes limit the amplitude of the ac voltage applied to Q3. They are connected in parallel but in opposite polarity from the tie point for components C19, R21, and R22 to the tie point for the oven bridge output lead and the base of Q3. MOD H changed the value of R6 to eliminate oscillation or motorboating of the oven heater circuit when the ambient temperature is above +65 degrees centigrade (+149 degrees Fahrenheit). This oscillation or motorboating will occur at any ambient temperature after the crystal oven has reached its operating temperature if the oven bridge balancing capacitor C20 has been selected improperly. Also repeated temperature cycling causes physical changes in the oven winding, requiring a change in C20 for proper capacitive bridge balance. A resistor, R41, has been added from terminal 3 to terminal 5 of transformer T1 for MOD K. This change prevents motorboating of the oven circuit at very low temperatures.

2.2.8 ISOLATION AMPLIFIER MODULE. (Figure 5-11)

2.2.8.1 100-KILOCYCLE AMPLIFIER. The 100-kilocycle frequency standard signal is fed through pin E of connector P1, isolation resistor R1, and coupling capacitor C1 to the control grid, pin 1, of amplifier V1. The plate output signal of V1 is developed in a 100-kilocycle, parallel-tuned circuit consisting of L1, C21, C5, C6, C7, and C8. Variable capacitor C5 is provided for tuning adjustments of the plate tank circuit. Capacitors C6, C7, and C8 form a capacitive voltage divider. A100-kilocycle signal is taken from the low-impedance tap at the junction of C7 and C8 and fed to pin F of connector P1 as a 100-kc output. A 100-kilocycle signal is taken from the high-impedance tap at the junction of C6 and C7 and fed to the times six multiplier.

2.2.8.2 MULTIPLIERS. The Isolation Amplifier module uses two multipliers, times six multiplier V2 and times four multiplier V3, to obtain a 2.4-megacycle output from the 100-kc input. The high impedance output of the 100-kilocycle amplifier, junction of C6 and C7, is directly coupled to the control grid, pin 1, of multiplier V1. This signal drives multiplier V1 into harmonic generation. The plate circuit of multiplier V1, consisting of L2, C11, C12, and C13, is tuned to the sixth harmonic or 600 kilocycles. This 600-kilocycle signal is directly coupled to the control grid, pin 1, of multiplier V2 from the junction of C12 and C13. The 600-kilocycle signal drives multiplier V2 into harmonic generation. The plate circuit of multiplier V2, consisting of L3, C15, C16, and C18, is tuned to the fourth harmonic or 2.4 megacycles. The 2.4-megacycle signal is taken from the junction of C16 and C17 and fed to pin D of P1 as a 2.4-megacycle output signal.

SECTION III
MAINTENANCE

3.1 TEST EQUIPMENT REQUIRED.

Table 3-1 lists test equipment required for trouble analysis and alignment of Frequency Generator 786E-1. Equivalent instruments may be substituted for those recommended.

TABLE 3-1
TEST EQUIPMENT REQUIRED

ITEM	DESCRIPTION OR TYPE
Communications Receiver	Collins 51J-4 or equivalent (R390)
R-F Signal Generator	Measurements Corporation 65B
Milliammeter	0-1 ma, zero center, (no more than 100 ohms resistance)
Resistor	51-ohm, 1/2-watt, noninductive
Resistor	150-ohm, 1/2-watt
Resistor	33-ohm, 1/2-watt
Vacuum-Tube Voltmeter	Hewlett-Packard 400D with r-f probe
Vacuum-Tube Voltmeter	Hewlett-Packard 410B with r-f probe
Vacuum-Tube Voltmeter	Ballantine 314
Resistor	47-ohm, 10-watt, wire-wound
Oscilloscope	DuMont 304H
Electronic Counter	Hewlett-Packard 524B
Milliammeters (2)	0-25 ma

3.2 OPERATING CHECKS AND ADJUSTMENTS.

3.2.1 SMO OPERATION.

The AFC meter (on front panel) provides visual means of checking for stabilizing loop correction. The deflection of the meter is proportional to the frequency correction of the master oscillator by the SMO stabilizing loop. Turn the FREQUENCY CHANGE knob from one end of the band to the other. If the meter deflection is greater than ±90 microamperes, the SMO should be checked. For the model B and model C SMO, use the following AFC meter limits for indication of faulty operation:

BAND 1 FREQUENCY	MAXIMUM AFC
Up to 2.0 mc	90 ua
2.0 to 2.5 mc	80 ua
2.5 to 3.0 mc	70 ua
3.0 to 3.7 mc	50 ua

NOTE

Refer to band 1 dial reading for AFC meter indication. This applies regardless of the band on which the radio set may be operating.

When the TUNE-OPERATE switch is placed in the TUNE position (disabling SMO loop) the AFC meter should return to approximately zero reading. If the meter reads zero at all frequencies when the TUNE-OPERATE switch is in the OPERATE position, the stabilizing loop is not correcting the master oscillator or the meter circuit is defective. Operation of the SMO loop can also be checked by loosely coupling the SMO output (test point J13 on SMO) to a communications receiver in the range of 2-4 mc. (The SMO frequency should be 300 kc above the band 1 dial reading.) When the SMO frequency is changed by moving the FREQUENCY CHANGE knob, frequency steps of 500 cps should be heard in the receiver. When the TUNE-OPERATE switch is placed in the TUNE position and the FREQUENCY CHANGE knob is turned, a normal nonstepping beat note should be heard, indicating the SMO loop is disabled.

3.2.2 SIDESTEP OSCILLATOR OPERATION.

While observing the AFC meter, the deflection should move about one division when switching from band 3-0 to 3-1. Deflection of about 1/2 a division should be observed when switching from bands 4-0 to 4-1, 4-1 to 4-2, and 4-2 to 4-3. The amount of deflection is nominal, but perception of the deflection is an indication of a change in the master oscillator frequency. If these deflections do not occur, check Sidestep Oscillator circuit or SMO operation.

3.2.3 R-F TUNER OPERATION.

a. Set TUNE-LOCAL-EXTERNAL CONTROL switch on the sideband generator to the TUNE (carrier reinsert) position. Set meter function switch to the RF OUT position. Turn EXCITER GAIN control fully counterclockwise.

b. Key exciter. Turn EXCITER GAIN control clockwise, and note that meter on the sideband generator

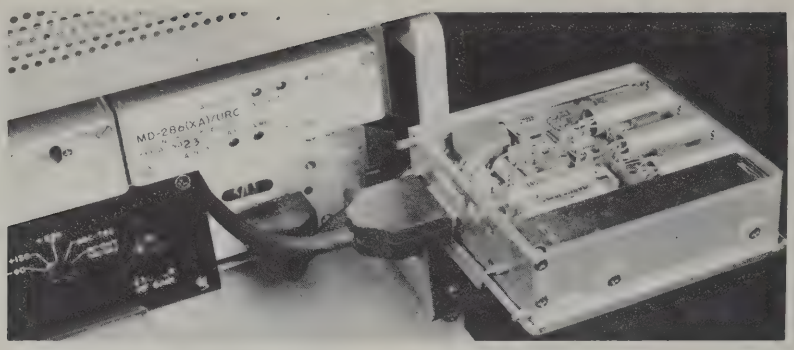


Figure 3-1. Typical Application of Extension Cable for Module Service

indicates at least 40 db. If the meter indication is less than 40 db, check R-F Tuner module or carrier reinsert adjustment (sideband generator instructions, TD-114, paragraph 3.4.6).

3.2.4 CALIBRATION CHECK.

NOTE

If a frequency comparator, such as the Collins 54Q-1, is available, use it is place of the oscilloscope for calibration.

a. Apply the 1000-cycle reference signal from Frequency Generator 786E-1 to the vertical input of an oscilloscope. The 1000-cycle reference signal is obtained at the junction box (see system junction box diagram).

b. Apply the receiver audio output of the equipment to the horizontal input of the oscilloscope.

c. Tune the receiver to a frequency exactly 1000 cycles below the frequency of a common reference station of known good stability and accuracy, such as WWV or a net station equipped with a master frequency standard. For example, if the 15-megacycle signal from WWV is used as the reference frequency, tune the receiver to 14,999 kc. Switch the equipment for upper sideband (USB) on the audio and control unit.

d. The 1000-cycle reference signal from Frequency Generator 786E-1 chassis together with the 1000-cycle beat note between receiver frequency and the reference station frequency will form a Lissajous figure on the oscilloscope screen. Unless the two tones are frequency synchronized, the figure will be unstable and will "rotate" on the screen. Adjust the oscilloscope for a good pattern.

e. Adjust L1 on the Reference Oscillator module until a slowly rotating 1-to-1 Lissajous figure is obtained on the oscilloscope screen. This slow rotation rate is necessary to accurately determine the Lissajous ratio. After confirming a 1-to-1 ratio, adjust L1 for minimum rotation rate of the Lissajous figure. The number of complete cycles of the Lissajous figure per second indicates the frequency error in cycles per second.

3.3 TROUBLE ISOLATION.

3.3.1 TROUBLE ISOLATION TO A MODULE.

The proper procedure for trouble isolation is to first isolate the trouble to a defective module. Table 3-2 lists the test-point voltages for locating a defective module using signal tracing procedures. See figures 3-3 through 3-8 for test-point location. If the isolation amplifier is being used, a 100-kc signal is injected into the isolation amplifier. Test-point voltages are taken with Frequency Generator 786E-1 installed in an operating system. All voltage measurements, except J1 on the R-F Tuner module, were made with a Hewlett-Packard 410B. The measurement at J1 on the R-F Tuner was made with a Hewlett-Packard 400D. After the trouble has been isolated to a defective module, the module may be replaced with a good module or may be repaired by isolating the trouble to a defective part in the module.

Figure 3-2. SMO Module Showing Extension Board in Use

3.3.2 MODULE TROUBLE ISOLATION.

Once trouble has been isolated to a module, conventional trouble-shooting procedures can be used to locate a defective part with the aid of the module schematic, the oscilloscope waveforms of table 3-4, and the voltage and resistance measurements of table 3-5. Pendant cables (figure 3-1) and extension boards (figure 3-2) may be used to connect the module or subassembly to the chassis for accessibility and convenience during testing. Table 3-3 lists the transmit, receive, and injection signal levels for each band of the R-F Tuner module. The transmit and receive levels given are the signal generator level necessary at each test jack to produce a 20-db R-F OUT and a 20-db agc reading (respectively) on meter M1 of the sideband generator. These measurements are made with RECEIVER RF GAIN control and EXCITER RF GAIN control (on sideband generator) set at maximum. All other controls are left at normal operating settings. A 20-db agc reading on M1 corresponds to an agc bus voltage of -2.6 volts as read on a d-c vacuum-tube voltmeter, and a 20-db RF OUT reading corresponds to 1.58 volts r-f at J10 on the chassis (J10 termination in 50 ohms). For injections to J11 on the chassis, a 33-ohm resistor is connected in series with the signal generator signal lead. All readings are in microvolts unless otherwise indicated. Injection levels are the same for transmit or receive function. Table 3-6 gives complete trouble-isolation procedures for the Stabilized Master Oscillator module.

3.3.3 VOLTAGE AND RESISTANCE MEASUREMENTS.

Table 3-5 lists by modules the voltage and resistance measurements for Frequency Generator 786E-1. Unless indicated, all measurements are taken from terminal, or identified point, to ground with a Hewlett-Packard 410B VTVM. All a-c voltage measurements of less than one volt are taken with a Hewlett-Packard 400D VTVM. Unless otherwise noted, voltage measurements are made with the module plugged into the chassis, or connected to the chassis with pendant cables or extension boards, and operating with no input signals. On R-F Tuner module measurements, T and R indicate transmit and receive mode of operation.

All resistance measurements on modules are taken with the module removed from the chassis. Resistance measurements on the Stabilized Master Oscillator module are made with all subassemblies plugged in and the Stabilized Master Oscillator unplugged from the chassis. Readings marked with an asterisk (*) may vary widely due to diode action. Be careful in measuring resistance at transistor terminals to observe proper polarity and to use highest meter range practicable to avoid excessive base current in the transistors. Be sure to ground the common lead of the Hewlett-Packard 410B when making resistance measurements on transistors.

Voltage measurements on Q1, Q2, Q3, Q4, and HR1 of the Reference Oscillator module are taken with the leads to HR1, terminals 1 and 3 disconnected and connected across a 47-ohm, 10-watt, wirewound resistor and a 0.1-volt, 5-kc signal from a Hewlett-Packard 200C/D Audio Oscillator applied across HR1 terminals 1 and 3.

CAUTION

Do *not* change tuning adjustments on the Reference Oscillator module with the cover removed.

TABLE 3-2. TROUBLE ISOLATION TO MODULE

TEST POINT	FREQUENCY	NORMAL SIGNAL	IF ABNORMAL
Isolation Amplifier module			
J1	100 kc	1.3 volts a-c	Check 100-kc standard input.
J4	2.4 mc	1.0 to 1.5 volts a-c	Check Isolation Amplifier module.
Frequency Divider module			
J1	100 kc	Not more than 2 volts a-c	Check Reference Oscillator module or Isolation Amplifier module.
J2	4 kc	Not more than 2 volts a-c	Check Frequency Divider module.
J3	1 kc	Not more than 1.5 volts a-c	Check Frequency Divider module.

TABLE 3-2. TROUBLE ISOLATION TO MODULE (Cont)

TEST POINT	FREQUENCY	NORMAL SIGNAL	IF ABNORMAL
Sidestep Oscillator module			
J1	2.4 mc	1.0 to 1.5 volts a-c	Check Reference Oscillator module or Isolation Amplifier module.
J2	2.4 mc	0.4 to 1.0 volt a-c (on bands 3-1, 4-1, 4-2, 4-3)	Check Sidestep Oscillator module and relay K1 on 786E-1 chassis. NOTE Normal condition is no readings on bands 1 and 2, 3-0, and 4-0.
Stabilized Master Oscillator module			
J2	100 kc	1 to 3 volts d-c	Check Reference Oscillator module.
J13	2 to 4 mc	0.8 to 3.0 volts rms	Check Stabilized Master Oscillator (SMO) module.
J3	D-c	-3 to -8 volts d-c NOTE Bias may be -6 to -20 volts d-c, depending on date of manufacture.	Check SMO r-f tuner subassembly frequency multiplier CR1-CR4.
J12	30.448 mc	0.5 to 3.0 volts rms	Check SMO r-f tuner subassembly frequency multiplier V1.
A7J1	455 kc	1.5 to 10 millivolts a-c	Check SMO 4-kc spectrum generator subassembly.
A7J2	D-c	+0.4 to +0.6 volts d-c*	Check SMO reference i-f amplifier subassembly.
A2J1	455 kc	3.75 to 4.0 volts rms	Check SMO signal amplifier, i-f mixers, or interpolation oscillator subassemblies.
A2J2	D-c	+0.4 to +0.6 volts d-c*	Check SMO signal amplifier, i-f mixers, or interpolation oscillator subassemblies.
R-F Tuner module			
J1	300 kc	15 mv rms (keyed and carrier reinserted)	Check carrier generator module in Sideband Generator 786F-1.
**M1 (R-F OUT)	2 to 30 mc	At least 40 db (keyed with carrier reinserted, EXCITER R-F GAIN at max)	Check transmit operation of R-F Tuner module.
**M1 (AGC)	2 to 30 mc	About 40 db (100 uv applied at J12, RECEIVER R-F GAIN at max)	Check receive operation of R-F Tuner module.

*These values are critical. If reading is more than 0.6 volt, SMO correction loop is probably not operating.
**Meter M1 is located on the front panel of the sideband generator.

TABLE 3-3. R-F TUNER MODULE, SIGNAL LEVELS

TEST POINT (See figure 3-3.)	SIGNAL VOLTAGE			
	BAND 1	BAND 2	BAND 4	BAND 3
*Transmit Levels				
J1	1700	3000	3300	15,000
J3	750	6500	10,000	18,000
J5	---	14,000	16,000	28,000
J6	11,500	9000	27,000	32,000
J7	---	170,000	---	---
J8	220,000	200,000	330,000	330,000
*Receive Levels				
J11 (on chassis)	10	14	7	20
J13	42	130	85	49
J12	---	800	400	400
J10	525	750	700	600
J2	12,000	12,000	12,000	12,000
Injection Levels				
J9	2.5 v	2.5 v	2.5 v	2.5 v
J14	53.0 v	53.0 v	53.0 v	53.0 v
J15	---	2.5 v	1.2 v	3.6 v
J11	---	10.5 v	3.0 v	3.0 v

*The levels given for transmit and receive are typical but not necessarily precise. They are intended to show stage gain. All readings are nominal and may vary considerably from unit to unit or from band limit to band limit. Readings were taken at alignment frequencies (1.900 mc on BAND 1, 4.100 mc on BAND 2, 8.500 mc on BAND 3, and 17.300 mc on BAND 4). Leave FREQUENCY CHANGE control set so BAND 4 window reads 17.300 mc, and change bands with the BAND CHANGE control. See figure 3-3 for test jack location.

TABLE 3-4. OSCILLOSCOPE WAVEFORMS

HORIZONTAL		VERTICAL		WAVEFORM DESCRIPTION
TEST POINT	FREQUENCY	TEST POINT	FREQUENCY	
REFERENCE OSCILLATOR MODULE				
Q7-e	3 mc	Q9-e	600 kc	Five-lobe Lissajous pattern (5 to 1)
Q9-e	600 kc	P1-F	100 kc	Six-lobe Lissajous pattern (6 to 1)

TABLE 3-4. OSCILLOSCOPE WAVEFORMS (Cont)

HORIZONTAL		VERTICAL		WAVEFORM DESCRIPTION
TEST POINT	FREQUENCY	TEST POINT	FREQUENCY	
FREQUENCY DIVIDER MODULE				
Sweep	100 kc	Q1-c	100 kc	Clipped sine wave
Q3-c*	20 kc	Q1-c	100 kc	Five-lobe Lissajous pattern (5 to 1)
Q5-c*	4 kc	Q3-c*	20 kc	Five-lobe Lissajous pattern (5 to 1)
Q7-c*	1 kc	Q5-c*	4 kc	Four-lobe Lissajous pattern (4 to 1)
ISOLATION AMPLIFIER MODULE				
J1	100 kc	J3	600 kc	Six-lobe Lissajous pattern (6 to 1)
J3	600 kc	J4	2.4 mc	Four-lobe Lissajous pattern (4 to 1)
*Connect through a 330K resistor.				

TABLE 3-5
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
FREQUENCY DIVIDER MODULE (100-kc input)			
Q1-e	---	---	0
c	10.5	7.2	4.2K
b	0.28	0.46	700
Q2-e	---	---	---
c	8.9	7.2	18 to 20K
b	0.58	0.18	20 to 100K
Q3-e	---	---	---
c	5.5	6.0	18 to 20K
b	-0.8	6.0	20 to 100K

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
FREQUENCY DIVIDER MODULE (Cont) (100-kc input)			
Q4-e	---	---	---
c	9.6	6.9	18 to 20K
b	0.52	0.66	20 to 100K
Q5-e	---	---	---
c	---	---	18 to 20K
b	---	---	20 to 100K
Q6-e	---	---	---
c	7.2	6.2	18 to 20K
b	0.44	1.32	20 to 100K
Q7-e	---	---	---
c	6.8	5.8	18 to 20K
b	0.40	1.2	20 to 100K

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
SIDESTEP OSCILLATOR MODULE (BAND switch in ADD 1, 2, or 3)			
V1-1	---	13	330K
2	0.6	3.4	470
3	---	0	0
4	-0.2	3.5	330K
5	120	2	Inf
6	---	6.3	2
7	110	---	Inf
8	0.6	3.4	470
V2-1	-0.2	2.5	47K
2	---	3.2	7
3	---	0	0
4	0	---	0
5	110	---	Inf
6	---	6.3	2
7	36	---	Inf
8	---	3.2	7
V3-1	0	---	65
2	0.3	---	470
3	---	0	0
4	0.47	---	470
5	2.4	---	Inf
6	---	6.3	2
7	21	---	Inf
8	0.3	---	470
V4-1	---	0.45	27
2	4	---	2200
3	---	0	0
4	---	3.8	1.4
5	110	4-5	Inf
6	---	6.3	2
7	110	---	Inf
8	4	---	2200
Q1-e	0	---	0
c	4.9	11.5	175K
b	0.25	0.37	240K
Q2-e	0	---	0
c	6	6	240K
b	-0.8	1.15	100K
STABILIZED MASTER OSCILLATOR MODULE			
V1-1	-13	---	1.1 meg
2	0	---	0
3	---	0	0
4	---	6.3	0.2
5	130	---	75K
6	32	---	15K
7	0	---	0

*Not used in stabilized master oscillator model B.

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
STABILIZED MASTER OSCILLATOR MODULE (Cont)			
V2-1	0	---	0
2	2.25	---	330
3	---	0	0
4	---	6.3	0.2
5	128	---	65K
6	82	---	72K
7	0	---	48K
V3-1	-1.7	---	10K
2	0	---	0
3	---	0	0
4	---	6.3	0.2
5	11	---	110K
6	50	---	90K
7	0	---	0
V4-1	---	6.3	0.2
2	6.0	---	2000
3	1.7	---	300
4	54	---	110K
5	NC	NC	NC
6	62	---	95K
7	5.8	---	48K
8	6.4	---	2000
9	---	0	0
*A2Q1-e	0	---	0
c	7.6	---	2000
b	0.58	---	940
*A2Q2-e	0	---	0
c	6.2	---	2200
b	0.62	---	950
A2Q3-e	13.5	---	5000
c	26	---	1000
b	15	---	2000
A2Q4-e	15.5	---	1200
c	15	---	7500
b	2.1	---	750
A2Q5-e	0.02	---	200
c	25	---	13K
b	0.43	---	13K
A2Q6-e	0.01	---	200
c	24.5	---	12.5K
b	0.42	---	13K
A3V1-1	0	---	1.5
2	NC	NC	NC
3	---	6.3	1
4	0	---	1.4
5	86	---	75K
6	---	0	0
7	86	---	75K
8	2.1	---	560

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
STABILIZED MASTER OSCILLATOR MODULE (Cont)			
A3V2-1	0	---	4
2	NC	NC	NC
3	---	0	0
4	0	---	22K
5	84	---	75K
6	---	6.3	0.2
7	84	---	75K
8	2.2	---	560
A5V1-1	-8	8	100K
2	---	1	0.5
3	---	0	0
4	---	1	0.5
5	80	25	90K
6	---	6.3	5
7	53	---	180K
8	---	1	0.5
A6V1-1	0	---	4
2	2.1	---	520
3	---	0	0.2
4	-0.1	---	22K
5	89	---	75K
6	---	6.3	1
7	89	---	75K
8	NC	NC	NC
A6Q1-e	0	---	0
c	12	---	12K
b	0.23	---	450
A6Q2-e	2.2	---	2200
c	2.8	---	12K
b	2.7	---	8500
A6Q3-e	1.1	---	2200
c	15	---	12.5K
b	1.65	---	9800
A7Q1-e	0.01	---	200
c	26	---	12K
b	0.45	---	13.5K
A7Q2-e	1.7	---	1500
c	17	---	8K
b	2.4	---	1400
A7Q3-e	16	---	7K
c	26	---	1100
b	17	---	7500
A8V1-1	110	---	0
2	16	---	0
3	0	---	0
4	16	---	1680
5	16	---	1680
6	0	6.3	15
7	16	---	0
8	110	---	0

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
R-F TUNER MODULE (set for 11.7 mc with 3-mc oscillator injection)			
V1-1	T -1.8	---	Inf
	R 130	---	Inf
2	T -90	---	30K
	R 0	---	30K
3	4.2	---	1K
4	---	0	Inf
5	---	0	Inf
6	T 130	---	Inf
	R -0.9	---	Inf
7	0	---	9
8	4.2	---	1K
9	---	6.3	Inf
V2-1	T 0	---	Inf
	R 0.65	---	Inf
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	T 110	---	Inf
	R -0.9	---	Inf
6	T 110	---	Inf
	R -0.9	---	Inf
7	T 1.5	---	130
	R 0	---	130
8	NC	NC	NC
V3-1	T -1.8	---	Inf
	R 130	---	Inf
2	T -90	---	28K
	R 0	---	28K
3	4.2	---	1K
4	---	0	Inf
5	---	0	Inf
6	T 135	---	Inf
	R -0.9	---	Inf
7	0	---	Inf
8	4.2	---	1K
9	---	6.3	Inf
V4-1	T 0	---	470K
	R -0.6	---	470K
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	T 110	---	Inf
	R -0.9	---	Inf
6	T 110	---	Inf
	R -0.9	---	Inf
7	T 0	---	68
	R 5.6	---	68
8	NC	NC	NC

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
R-F TUNER MODULE (Cont) (set for 11.7 mc with 3-mc oscillator injection)			
V5-1	T 0	---	470K
	R -0.6	---	470K
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	T 130	---	Inf
	R -0.9	---	Inf
6	T 130	---	Inf
	R 0.9	---	Inf
7	0	---	1K
8	NC	NC	NC
V6-1	T 2.75	---	68
	R 0	---	68
2	T 0	---	100K
	R -0.5	---	100K
3	T 155	---	Inf
	R -1.6	---	Inf
4	---	0	Inf
5	---	6.3	Inf
6	T 250	---	Inf
	R -1.6	---	Inf
7	0	---	0
8	T 155	---	Inf
	R -1.6	---	Inf
9	T 0	---	100K
	R -0.5	---	100K
V7-1	T -90	---	3.8 meg
	R -0.5	---	3.8 meg
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	T -1.8	---	Inf
	R 110	---	Inf
6	T -1.8	---	Inf
	R 110	---	Inf
7	T 0	---	Inf
	R 0.9	---	Inf
8	NC	NC	NC
V8-1	T -90	---	3.8 meg
	R -0.3	---	3.8 meg
2	T 0	---	Inf
	R 0.6	---	Inf
3	---	0	Inf
4	---	6.3	Inf
5	T -1.8	---	Inf
	R 100	---	Inf
6	T -1.8	---	Inf
	R 80	---	Inf
7	T 0	---	Inf
	R 0.6	---	Inf
8	NC	NC	NC

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
R-F TUNER MODULE (Cont) (set for 11.7 mc with 3-mc oscillator injection)			
V9-1	-35	---	1 meg
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	110	---	Inf
6	90	---	Inf
7	0	---	0
8	NC	NC	NC
V10-1	0	---	470K
2	0	---	0
3	---	0	Inf
4	---	6.3	Inf
5	110	---	Inf
6	110	---	Inf
7	2.3	---	270
8	NC	NC	NC
REFERENCE OSCILLATOR MODULE			
Q1-b	---	0.22	12
Q2-b	---	2.9	20
Q3-c	---	0.08	900
Q4-b	---	2.7	20
HR1-2	---	7.3	---
HR1-3	---	7.3	---
HR1-4	---	7.3	---
Q5-e	4.4	0	40K
c	0	0.2	7
b	4.4	0.18	100
Q6-e	4.4	0	40K
c	0.42	0.82	1000
b	4.4	0.16	1500
Q7-e	3.8	0.72	90K
c	0	3.0	7.5
b	4.4	0.94	100
Q8-e	4.0	0.16	40K
c	0.47	0.6	1000
b	4.1	0.3	1500

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
REFERENCE OSCILLATOR MODULE (Cont)			
Q9-e	3.9	0.55	100K
c	0	2.7	14
b	4.3	0.3	100
Q10-e	4.		
Q10-e	4.0	0.05	100K
c	0	3.0	2
b	4.3	0.4	60
Q11-e	4.1	0.2	100K
c	0	1.8	2
b	4.3	0.45	60
Q12-e	4.0	0.05	40.0K
c	0.85	2.25	2000
b	4.4	0.6	2000
Q13-e	2.8	0.37	9000
c	22	18.0	3000
b	3.3	0.38	11K

TABLE 3-5 (Cont)
VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS
ISOLATION AMPLIFIER MODULE			
V1-1	-1.1	---	90K
2	0	---	0
3	0	---	0
4	---	6.3	1.0
5	100	---	Inf
6	76	---	Inf
7	0	---	0
V2-1	-6.4	---	90K
2	0	---	0
3	0	---	0
4	---	6.3	1.0
5	150	---	Inf
6	58	---	Inf
7	0	---	0
V3-1	-2.4	---	90K
2	0	---	0
3	0	---	0
4	---	6.3	1.0
5	110	---	Inf
6	28	---	Inf
7	0	---	0

TABLE 3-6. SMO TROUBLE-ISOLATION CHART

PRELIMINARY INSTRUCTIONS

If test 1 checks out completely, it is not necessary to perform the succeeding tests. If test 1 does not check out, perform those tests which apply to the defective section of the SMO. Omit tests 8 and 9 for models B and C SMO. Omit tests 6 and 7 for model A SMO. Tests 1 through 5 apply to all models.

TEST NO. 1. OVER-ALL CHECK

PRELIMINARY INSTRUCTIONS

In the following procedure, monitor the SMO frequency as follows: Connect a short piece of coaxial cable to antenna terminals of communications receiver. Remove about 2 inches of braid from the coaxial cable. Remove dust cover from the 786E-1 and drop frequency dial panel. Hang the coaxial cable over the R-F Tuner module slug rack, but do not make a metallic connection to the chassis. Tip frequency dial panel up into position again (the frequency changes slightly when the dial panel is lowered).

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
1A	Connect Hewlett-Packard 410B for a-c operation at J2 of SMO.	J2	ON-OFF switch to ON.	1 to 3 v a-c.	

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
TEST NO. 1. OVER-ALL CHECK (Cont)					
1B	Connect Hewlett-Packard 410B for a-c operation at J13 of SMO.	J13	Same as 1A.	0.8 to 3.0 v a-c.	
1C	Monitor the SMO frequency (800 kc above the 786E-1 dial band 1 setting) with communications receiver.	SMO	ON-OFF switch to ON. TUNE-LOCAL-EXTERNAL CONTROL to LOCAL. Equipment conditioned to receive. Set frequency to 3.480 mc and set BAND CHANGE control to BAND 1. Change frequency slowly with FREQUENCY CHANGE control.	Distinct 500-cps steps should be heard as frequency is changed.	If frequency change is garbled or sharp only when turned in one direction, test 2 should be performed.
TEST NO. 2. FREQUENCY CHECK					
PRELIMINARY INSTRUCTIONS Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					
2A	Connect Hewlett-Packard 410B for d-c operation at A2J2.	A2J2	Normal operation.	+0.4 to +0.6 v d-c.	If indication is not normal, proceed to step 4A.
2B	Connect Hewlett-Packard 410B for d-c operation at A7J2.	A7J2	Same as 2A.	Same as 2A.	Same as 2A.
2C	Couple communications receiver to interpolation oscillator. Use antenna described in test 1, and lay coaxial cable along mechanical filter of interpolation oscillator (above A7J2). Do not make metallic connection to printed circuit board. Calibrate receiver at 800 kc, and set to read 837.4 kc.	Interpolation oscillator	Set 786E-1 frequency dial to 4.102 mc.	Interpolation oscillator frequency as monitored on receiver should be 837.0 to 837.8 kc.	If interpolation oscillator is not on frequency, adjust L2 through hole A of interpolation oscillator cover.
2D	Same as 2C with receiver set to 817.4 kc.	Same as 2C.	786E-1 frequency dial at 4.107 mc.	Interpolation oscillator frequency of 817.0 to 817.8 kc.	If interpolation oscillator is not on frequency, adjust (Cont)

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

TEST NO. 2. FREQUENCY CHECK (Cont)					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
2D (Cont)					(Cont) L7 through hole B in interpolation oscillator cover.
2E	Same as 2C with receiver set to 597.4 kc.	Same as 2C.	786E-1 frequency dial set to 4.112 mc.	Interpolation oscillator frequency of 597.0 to 597.5 kc.	If interpolation oscillator is not on frequency, adjust L12 through hole C of interpolation oscillator cover.
2F	Same as 2C with receiver set to 577.4 kc.	Same as 2C.	786E-1 frequency dial set to 4.117 mc.	Interpolation oscillator frequency of 577.0 to 577.5 kc.	If interpolation oscillator is not on frequency, adjust L17 through hole D in interpolation oscillator cover.
2G	Same as 2C with receiver set to 557.4 kc.	Same as 2C.	786E-1 frequency set to 4.122 mc.	Interpolation oscillator frequency of 557.0 to 557.5 kc.	If interpolation oscillator is not on frequency, adjust L22 through hole E of interpolation oscillator cover.
2H	Loosely couple communication receiver to SMO output (J13).	J13	Turn SMO through its frequency range (2-4 mc) by turning interpolation oscillator shaft. Observe AFC meter on front panel of 786E-1.	Average deflection each side of zero (center) scale should be equal. Distinct 500-cps steps should be heard in receiver as SMO frequency is changed. AFC meter should not read more than ±90 microamps at any point in the frequency range.	Remove SMO cover, loosen master oscillator shaft gear, and turn master oscillator shaft slightly in direction to bring AFC meter average deflection toward zero. Lock shaft, and turn SMO shaft. If distinct 500-cps steps are not heard in both directions, loosen master oscillator shaft, and turn in direction to bring AFC meter reading toward zero. Repeat until distinct 500-cps steps are heard in both directions.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

TEST NO. 3. REFERENCE CHANNEL CHECK					
PRELIMINARY INSTRUCTIONS Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
3A	Connect Hewlett-Packard 400D for a-c operation at A7J1, and check frequency by loosely coupling communications receiver to A7J1.	A7J1	Normal operating condition.	1.5 to 10 millivolts a-c at 455 kc (depending on interpolation oscillator frequency).	If normal, proceed to step 3B. If abnormal, proceed to step 3C.
3B	Same as 3A at P9-K. For stage gain check, inject 455-kc signal from signal generator through 0.1-uf capacitor and 1K-ohm resistor in series to base of A7Q1, A7Q2, and A7Q3. Remove the 4-kc divider subassembly, A6, and use a 10,000-microvolt input at A7Q1.	P9-K	Same as 3A.	0.35 to 0.50 volt a-c at 455 kc (depending on interpolation oscillator frequency).	If normal, proceed to test 6. If abnormal, check stage gain of reference i-f amplifier subassembly. The gain per stage of A7Q1 through A7Q3 should be 20 db.
3C	Same as 3A at J8-F, but use Hewlett-Packard 524B Counter to check frequency.	J8-F	Same as 3A, but set 786E-1 frequency dial to 3.506 mc.	0.8 to 1.5 volt a-c at 597 kc +400 cps, -0 cps. 1.0 to 2.0 volts a-c at 4 kc.	If normal, proceed to step 3D. If abnormal, check A5V1.
3D	Same as 3A at J8-A.	J8-A	Same as 3A.		If normal, proceed to step 3E. If abnormal, check Frequency Divider module.
3E	Check frequency at A6R15 with frequency counter or oscilloscope.	A6R15	Same as 3A.	4-kc spectrum 1.0 to 1.1 mc.	If normal, proceed to step 3F. If abnormal, check Q1, Q2, and Q3.
3F	Connect Ballantine 314 for a-c operation at pin 1 of A5V1.	Pin 1 of A6V1	Same as 3A.	10 to 40 millivolts a-c (1.0 to 1.1 mc).	If normal, proceed to step 3G. If abnormal, replace A6FL1.
3G	Repeat step 3A.	A7J1	Same as 3A.	1.5 to 10 millivolts a-c at 455 kc.	If abnormal, check A6V1, check circuit, replace A7FL1 if necessary.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

TEST NO. 4. SIGNAL CHANNEL CHECK					
PRELIMINARY INSTRUCTIONS Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive. Set frequency dial to 3.506 mc.					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
4A	Connect Hewlett-Packard 400D for a-c operation at J5-A, and check frequency by loosely coupling communications receiver to J5-A.	J5-A	Normal operating condition.	5 to 40 millivolts a-c at 455 kc.	If normal, proceed to step 4I to check stage gain of signal i-f amplifier subassembly. If abnormal, proceed to step 4B.
4B	Same as 4A at J5-L.	J5-L	Same as 4A.	15 to 60 millivolts a-c at 3.452 mc.	If normal, proceed to step 4C. If abnormal, proceed to step 5F.
4C	Same as 4A at J5-J.	J5-J	Same as 4A.	0.5 to 1.2 volts a-c at 2.4 mc, +0, -3.0 kc.	If normal, proceed to step 4D. If abnormal, align Sidestep Oscillator module.
4D	Check frequency at A3V1, pin 5, with communications receiver.	Pin 5 of A3V1	Same as 4A.	Approximately 1052 kc.	If normal, proceed to step 4E. If abnormal, check A3V1.
4E	Connect Hewlett-Packard 400D for a-c operation at pin 4 of A3V2.	Pin 4 of A3V2	Same as 4A.	20 to 100 millivolts a-c at 1052 kc.	If normal, proceed to step 4F. If abnormal, replace A3FL1.
4F	Connect Hewlett-Packard 410B for a-c operation at J5-D	J5-D	Same as 4A.	0.8 to 1.3 volts a-c.	If normal, proceed to step 4G. If abnormal, check A5V1 circuit.
4G	Check frequency at J5-D with communications receiver.	J5-D	Same as 4A.	597 kc +400 cps, -0 cps.	If normal, proceed to step 4H. If abnormal, align Interpolation Oscillator module (see steps 2C through 2G).
4H	Check frequency at pin 5 of A3V2 with communications receiver.	Pin 5 of A3V2	Same as 4A.	455 kc.	If abnormal, check A3V2.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
TEST NO. 4. SIGNAL CHANNEL CHECK (Cont)					
4I	Connect Hewlett-Packard 410B for a-c operation at A2J1. Inject 455-kc signal from signal generator through 0.1-uf capacitor and 1K-ohm resistor in series to base of A2Q6, A2Q5, A2Q4, and A2Q3. Use a 10,000-microvolt input at A2Q3.	A2J1	Set BAND CHANGE-ADD KC to BAND 2 ADD 1. Remove the Sidestep Oscillator module.	Over-all gain of 3.75 to 4 volts rms. (Model B SMO should have over-all gain of 8.0 to 10.0 volts rms.) Gain per stage 20 db.	If normal, proceed to step 5A.
TEST NO. 5. R-F SECTION CHECK					
PRELIMINARY INSTRUCTIONS					
Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive. Set frequency dial to 3.506 mc.					
5A	Connect Hewlett-Packard 410B for a-c operation at J13, and check frequency with Hewlett-Packard 524B Counter.	J13	Normal operating condition.	1.3 to 3.0 volts a-c at 3.806 mc ±1 kc.	If normal, proceed to step 5B. If abnormal, check master oscillator and Z1 tuning.
5B	Connect Hewlett-Packard 410B for d-c operation at J3.	J3	Same as 4A.	-3 to -8 volts d-c. NOTE Bias may be -6 to -20 volts d-c depending on date of manufacture.	If normal, proceed to step 5C. If abnormal, check doubler diodes and Z2 tuning.
5C	Connect Hewlett-Packard 410B for a-c operation at J12 and monitor frequency with Hewlett-Packard 524B Counter.	J12	Same as 4A.	0.5 to 3.0 volts a-c at 30.448 mc.	If normal, proceed to step 5D. If abnormal, check V1 and Z3 tuning.
5D	Connect Hewlett-Packard 410B for d-c operation at J2.	J2	Same as 4A.	-1 to 2.0 volts d-c.	If normal, proceed to step 5E. If abnormal, check Reference Oscillator module, tube V3, and L3 tuning.
5E	Check frequency at pin 1 of V2 of r-f tuner subassembly with communications receiver.	Pin 1 of V2	Set SMO frequency to 3.306 mc by setting 786E-1 frequency dial to 3.006 mc.	29.9 mc.	If normal, proceed to step 5F. If abnormal, check V4 and Z4 and Z5 for tuning.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
TEST NO. 5. R-F SECTION CHECK (Cont)					
5F	Check frequency at pin 5 of V2 with communications receiver.	Pin 5 of V2	Normal operating conditions.	3.452 mc.	If normal, recheck step 4B. If 4B is abnormal, replace FL1. If abnormal check V2.
TEST NO. 6. FREQUENCY DISCRIMINATOR CHECK					
PRELIMINARY INSTRUCTIONS This test should be performed on equipment with model B or C SMO only. If equipment has model A SMO, proceed to test no. 8. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					
6A	Connect Hewlett-Packard 410B for d-c operation between pins E and J of J4 and ground.	Pins E and J of J4.	Set BAND CHANGE-ADD KC to BAND 3, ADD 1. Remove Sidestep Oscillator module.	+16 volts d-c to ground at both points.	If normal, proceed to step 6B. If abnormal, replace master oscillator subassembly.
6B	Connect Hewlett-Packard 410B for d-c operation between pins E and J of J4. Connect ground lead of 410B to J4-E. Connect signal generator to pin A of J4, and inject 455-kc, ±100-cps, 10-millivolt signal through 0.1-uf capacitor and 1K ohm resistor in series.	Same as 6A.	Same as 6A.	0 to ±100 millivolts.	If normal, proceed to step 6C. If abnormal, align signal i-f amplifier subassembly.
6C	Same as 6B but change signal generator frequency to 462.5 kc.	Same as 6A.	Same as 6A.	+8.0 volts d-c.	Same as 6B.
6D	Same as 6B but change signal generator frequency to 447.5 kc.	Same as 6A.	Same as 6A.	-8.0 volts d-c.	Same as 6B.
6E	Connect Ballantine 314 for a-c operation at cathode of A2CR1. Connect signal generator to pin A of J4, and inject a 455-kc ±100-cps, 10-millivolt signal through a 0.1-uf capacitor and a 1K-ohm resistor in series.	A2CR1	Same as 6A.	4 volts a-c.	If normal, check diode. If abnormal, check A2C26, C27, C32, and C33 and A2L1 and A2L2.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

TEST NO. 6. FREQUENCY DISCRIMINATOR CHECK (Cont)					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
6F	Leave signal generator connected as in 6E, and connect Ballantine 314 for a-c operation at cathode of A2CR2.	A2CR2	Same as 6A.	Same as 6E.	Same as 6E.
6G	Same as 6E with signal generator set to 462.5 kc.	Same as 6E.	Same as 6A.	7 volts rms.	Same as 6E.
6H	Same as 6F with signal generator set to 447.5 kc.	Same as 6F.	Same as 6A.	Same as 6G.	Same as 6E.
TEST NO. 7. PHASE DISCRIMINATOR CHECK					
PRELIMINARY INSTRUCTIONS This test should be performed on equipment with model B SMO or C only. If equipment has model A SMO, proceed to test no. 8. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					
7A	Connect Hewlett-Packard 410B for d-c operation between J4-J and ground.	J4-J	Normal operating conditions.	The +16-volt reference swings to +1.0 volt as A2T4 is adjusted each side of center. Adjust A2T4 for center position.	If normal, check components from R27 to J4 pin J. If abnormal, proceed to step 7B.
7B	Connect Ballantine 314 for a-c operation at input to A2CR5.	A2CR5	Same as 7A.	1.4 volts a-c.	If normal, check A2CR5. If abnormal, check A2T4.
7C	Connect Ballantine 314 for a-c operation at input to A2CR6.	A2CR6	Same as 7A.	1.4 volts a-c.	If normal, check A2CR6. If abnormal, check A2T4.
TEST NO. 8. PHASE-LOCK CHECK					
PRELIMINARY INSTRUCTIONS This test should be performed on equipment with model A SMO only. If equipment has model B or model C SMO, perform test no. 7 instead. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
TEST NO. 8. PHASE-LOCK CHECK (Cont)					
8A	Remove power from SMO, and install two 25-ma d-c meters at terminals E1 through E4. Observe proper polarity. E1 and E3 are positive. Connect one meter from E1 to E2 and one meter from E3 to E4.	E1-E4	Normal operating condition.	Currents nearly balanced. Both currents above 4 ma.	If normal, proceed to step 8D. If abnormal, replace signal i-f amplifier subassembly. If no current is indicated, proceed to step 8B.
8B	Connect Hewlett-Packard 410B for a-c operation at A2J1.	A2J1	Same as 8A.	3.75 to 4.0 volts a-c.	If normal, proceed to step 8C.
8C	Connect Hewlett-Packard 410B for d-c operation between E1 and ground and E3 and ground.	E1, E3	Same as 8A.	+28 volts at both points.	If +28 volts is not indicated, and step 8B was normal, A1Z1 in the master oscillator subassembly may be open.
8D	Monitor master oscillator frequency with Hewlett-Packard 524B Counter (at J13).	J13	Set SMO frequency to 4.000 mc by setting frequency dial to 3.700 mc. Adjust interpolation oscillator frequency to 4.000 mc ±50 cps using A1L2. Ground A7J2. Remove ground from A7J2, and note master oscillator error from 4.00 mc.	Master oscillator error should be -25 cps. If not, adjust A2R3 with signal i-f amplifier subassembly, connect to SMO through extension board until the master oscillator with frequency lock is 4.000 mc ±25 cps. Remove ground from A7J2 and check that SMO phase locks to 4.000 mc.	If abnormal, adjust A2R3.
TEST NO. 9. FREQUENCY-LOCK CHECK					
PRELIMINARY INSTRUCTIONS					
This test should be performed on equipment with a model A SMO only. If equipment has a model B or model C SMO, perform test no. 6 instead. Set ON-OFF switch to ON. Set TUNE-LOCAL-EXTERNAL CONTROL switch to LOCAL. Condition equipment for receive.					
9A	Check frequency at J13 with Hewlett-Packard 524B Counter.	J13	Turn SMO through its frequency range by turning FREQUENCY CHANGE dial. The master oscillator frequency will be 300 kc above the dial reading.	Master oscillator error not more than ±1 kc from 2.0 to 4.0 mc.	If abnormal, align master oscillator shaft.

TABLE 3-6. SMO TROUBLE-ISOLATION CHART (Cont)

TEST NO. 9. FREQUENCY-LOCK CHECK (Cont)					
STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	NORMAL INDICATION	REMARKS
9B	Connect Hewlett-Packard 400D for a-c operation at pin A of J4 to monitor tracking of Z4 and Z5.	J4-A	Same as 9A.	Z4 and Z5 tracked from 2.0 to 4.0 mc.	If tracking is abnormal, proceed to step 9C.
9C	Connect 400D for a-c operation at J4-A.	J4-A	Set frequency dial to 1.906 mc, and adjust slugs of Z4 and Z5 for maximum indication on 400D. Set frequency dial to 3.506 mc, and adjust capacitors of Z4 and Z5 for maximum indication on 400D. Repeat until tracking is normal.	Z4 and Z5 tracked from 2.0 to 4.0 mc.	

3.4 ALIGNMENT PROCEDURES.

3.4.1 GENERAL.

Each subassembly requiring alignment is considered separately in the following procedures. Alignment of some modules requires use of the extension cables and extension boards (figures 3-1 and 3-2).

WARNING

Dangerous voltages are present. Use care when working on the equipment with power applied and circuitry exposed.

Use a vtvm or oscilloscope with r-f probe whenever measurements are made at r-f potential or signal points.

3.4.2 R-F TUNER MODULE ALIGNMENT
(See figures 3-3 and 5-2.)

3.4.2.1 REMOVAL, REPLACEMENT, AND MECHANICAL ALIGNMENT. The R-F Tuner module may be aligned without removal from the chassis, but if it is necessary to remove, repair, and replace the module, proceed as follows:

a. To remove the R-F Tuner module, loosen the left half of the Oldham coupler and remove loading spring from left side and leave attached to right side of the coupler. Slide the left half of the coupler to the left, disengaging the coupler. Loosen the four captive screws, and pull the module from the chassis.

b. To replace, move the slug rack all the way down in the R-F Tuner module. Set the coupler on the turn so that the extended arm on the coupler is about 1/8-inch from the upper-left hold-down screw as viewed when mounted in the chassis.

c. Mount the module on chassis, tighten captive screws, engage coupler, but leave left coupler clamp loose. Place loading spring between two coupler halves. Apply power and allow five-minute warmup.

d. Set the TUNE-LOCAL-EXTERNAL CONTROL switch on the sideband generator to TUNE position, turn EXCITER RF GAIN control to maximum, and place multimeter switch in RF OUT position.

e. Key the equipment to transmit function, and move the slug rack out slowly (using extended arm on coupler as lever) until the multimeter indicates exciter output. Reduce the EXCITER RF GAIN control if meter is pegged and then obtain a peak meter indication.

CAUTION

Be sure to adjust slug rack to the first signal indication as the slug rack is moved out. The next signal indication will be caused by the SMO frequency and will usually be stronger. If indication cannot be removed by setting TUNE-LOCAL-EXTERNAL CONTROL switch on sideband generator to LOCAL, the tuner is tuned to the wrong indication.

f. Watch indication on sideband generator meter, and tighten the left coupler clamp taking care not to move adjustment. This completes the replacement procedure.

3.4.2.2 R-F AND I-F CIRCUIT ALIGNMENT, TRANSMIT FUNCTION. On the sideband generator, set the TUNE-LOCAL-EXTERNAL CONTROL switch to TUNE position and the multimeter switch to RF OUT position. During the following adjustments, control the signal level in the R-F Tuner module so that at final peak adjustment the meter on sideband generator reads not more than 20 db. Key the equipment to transmit condition.

a. Shunt Z2 and Z5 to ground through 8200-ohm resistors at J2 and J4 respectively. Set band 1 frequency dial to 1.900 mc, and adjust slugs of Z25, Z1, Z2, Z3, Z4, Z5, Z6, Z14, and Z21 for maximum indication on meter (keeping indication at approximately 20 db with EXCITER RF GAIN). Adjust the slugs in the order listed.

b. Set BAND CHANGE control to BAND 2 (leaving FREQUENCY CHANGE control set as above). Remove the 8200-ohm resistors from J2 and J4, and peak slugs of Z7, Z8, Z15, Z18, Z19, Z20, Z22, and T1 (in that order) for maximum reading on M1 (keep indication at approximately 20 db with EXCITER RF GAIN control).

c. Set the BAND CHANGE control to BAND 3 ADD 0 position, and peak slugs of Z28, Z9, Z10, Z16, and Z23 (in that order) using same indication and control as in step b.

d. Set BAND CHANGE control to BAND 4 ADD 0 position, and peak slugs of Z26, Z27, Z29, Z30, Z11, Z12, Z13, Z17, and Z24 (in that order) using same indication and control as in step b.

NOTE

During slug adjustment of Z26, Z27, Z28, Z29, and Z30 (bands 3 and 4), check r-f voltage at J11 with Hewlett-Packard 410B and r-f probe. If it is difficult to obtain 2.5 volts at this point, some of these slugs may be adjusted to the wrong harmonic of the SMO frequency. Readjust slugs to obtain peak vtvm indication at point where slug is farthest into coil.

e. Set the FREQUENCY CHANGE control so band 1 frequency dial shows 3.500 mc, and replace the 8200-ohm resistors from J2 and J4 to ground. Set BAND CHANGE control to BAND 1.

f. Peak trimmer capacitors of Z25, Z1, Z2, Z3, Z4, Z5, Z6, Z14, and Z21 (in that order) for maximum meter indication (M1 of sideband generator). Peak meter reading with gain control as in step b. Remove 8200-ohm resistors.

g. Set the BAND CHANGE control to BAND 2, and peak trimmer capacitors of Z7, Z8, Z15, Z18, Z19, Z20, and Z22 using same procedure as in step b.

h. Set BAND CHANGE to BAND 3 ADD 0 position, and peak trimmer capacitors of Z28, Z9, Z10, Z16,

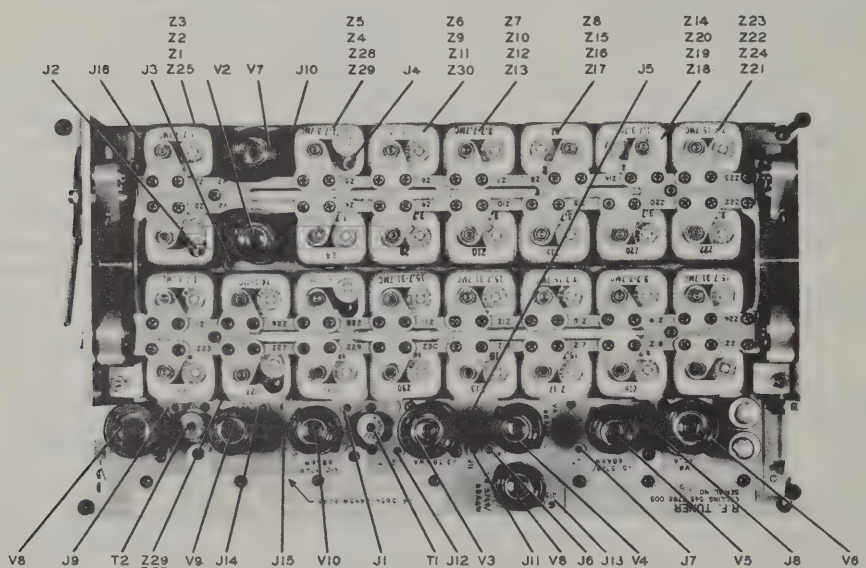


Figure 3-3. R-F Tuner Alignment Points

and Z23 (in that order). Set BAND CHANGE control to BAND 2, and peak C176 (located down in Z28).

i. Set BAND CHANGE control to BAND 4 ADD 0 KC, and peak trimmer capacitors of Z27 (C129 located at top of can; do not peak C91 at this time), Z26 Z29, Z30, Z11, Z12, Z13, Z17, and Z24 (in that order). Set BAND CHANGE control to BAND 3, and peak C91 (down in Z27).

j. The above alignment procedure may have to be repeated to obtain proper tracking across the band.

3.4.2.3 R-F AND I-F CIRCUIT ALIGNMENT, RECEIVE FUNCTION. Since all of the tuned circuits used in receive function are also used in transmit function, except T2, align as in paragraph 3.4.2.2. Condition equipment for receive, and adjust T2 for maximum noise or signal. Receiver alignment is also complete.

3.4.3 REFERENCE OSCILLATOR MODULE ALIGNMENT.

Before alignment, allow equipment to warm up for 15 minutes. Remove Reference Oscillator module from chassis, and connect through extension cable to chassis. Remove cover, and replace with special accessory cover which has access holes (for alignment purposes only). While cover is removed, short Q5 collector to ground, disabling the 3.0-mc oscillator.

CAUTION

Do not attempt alignment with cover removed. Distributed capacity provided by the cover is part of the capacity of tuned circuits. Do not make any adjustment of L1 in the 3.0-mc crystal oscillator circuit at this time. This adjustment is to be made only as a system adjustment. Never experiment with alignment. Align only after all trouble analysis indicates necessity.

a. Connect signal generator through a blocking capacitor to base of Q6. Connect oscilloscope vertical input to Q7 emitter and horizontal input to Q9 emitter. Monitor the frequency with communications receiver, and set signal generator to 3.100 mc, 0.1 volt. Adjust C11 for a five-lobe Lissajous pattern on oscilloscope. Adjust signal generator output to keep oscilloscope presentation on screen and, if necessary, insert series dropping resistors in oscilloscope leads.

b. Set signal generator to 2.900 mc (monitored in communications receiver), and adjust C26 for the five-lobe Lissajous pattern.

c. Set signal generator to 3.0 mc, 0.1 v, and check that oscilloscope presents 5-to-1 Lissajous pattern. Repeat steps a and b, if necessary, moving signal generator frequencies closer to 3.0 mc until the circuit divides frequency by five over the widest possible bandwidth (centered on 3.0 mc).

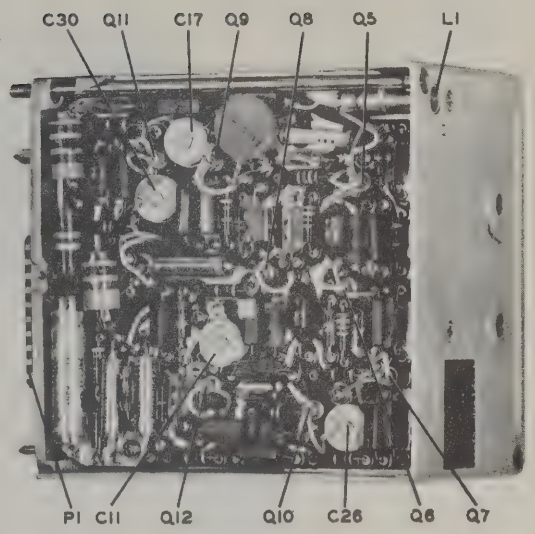


Figure 3-4. Reference Oscillator Alignment Points

d. Connect the signal generator to Q8 base, and move the oscilloscope vertical input connection from Q7 emitter to pin F of P1. Set the signal generator to 620 kc, and adjust C17 for a six-lobe Lissajous pattern on the oscilloscope.

e. Set signal generator to 580 kc, and adjust C30 for six-lobe Lissajous pattern on oscilloscope.

f. Set signal generator to 600 kc, and check that oscilloscope presents 6-to-1 Lissajous pattern. Repeat steps d and e, if necessary, moving signal frequencies closer to 600 kc until the circuit divides by six over the widest possible bandwidth (centered on 600 kc).

g. Remove signal generator connections, and remove short from Q5 collector. Check with oscilloscope for 5-to-1 frequency division from Q7 emitter to Q9 emitter and for a 6-to-1 division from Q9 emitter to pin F of P1. Measure 2.4-mc and 100-kc outputs at P1 with r-f vtvm. Outputs should measure 1.0 to 1.5 volts rms. Remove special cover, and replace regular cover. Replace module on chassis, and secure with captive screws.

3.4.4 ISOLATION AMPLIFIER MODULE ALIGNMENT.

a. Apply a 100-kc standard signal to J14 on Frequency Generator 786E-1 chassis.

b. Connect a vtvm (10-volt a-c scale) to test point J2, and adjust C5 for maximum vtvm indication.

c. Connect test point J1 (100 kc) to the horizontal input of an oscilloscope. Connect test point J3 (600 kc) to the vertical input of the oscilloscope. Adjust C11 for a 6-to-1 Lissajous figure on the oscilloscope.

d. Connect test point J3 (600 kc) to the horizontal input of the oscilloscope. Connect test point J4 (2.4 mc) to the vertical input of the oscilloscope. Adjust C15 for a 4-to-1 Lissajous figure on the oscilloscope.

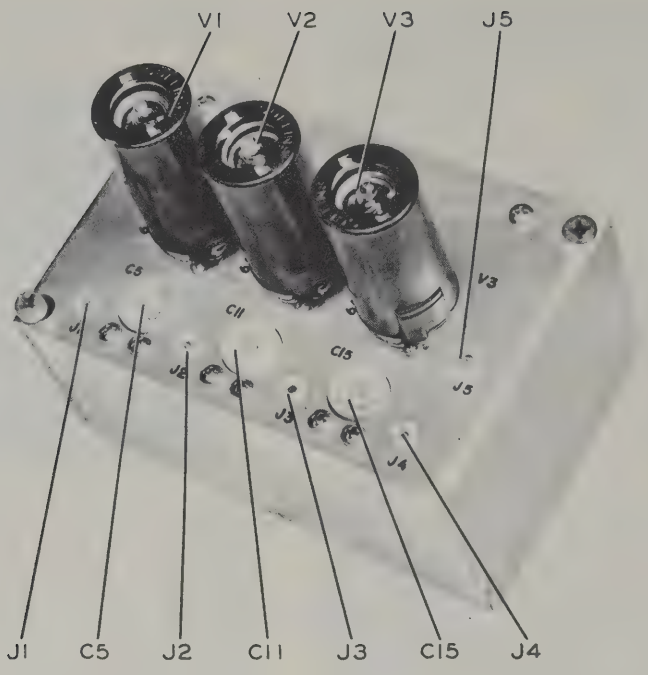


Figure 3-5. Isolation Amplifier Alignment Points

3.4.5 SIDESTEP OSCILLATOR MODULE ALIGNMENT.

a. Place the 786E-1 BAND CHANGE control to BAND 3 ADD 1 KC.

b. Connect a vtvm (2.5-volt a-c scale) to test point J2.

c. Adjust C21, T2, and L2 for maximum indication on vtvm.

3.4.6 STABILIZED MASTER OSCILLATOR MODULE ALIGNMENT.

3.4.6.1 REMOVAL AND REPLACEMENT OF SMO MODULE.

a. Remove power from the equipment, set the band 1 dial to approximately 1700, and lower the control panel on Frequency Generator 786E-1. Swing out chassis immediately above to give access to the top parts of Frequency Generator 786E-1.

b. Turn dial (with control panel lowered) so that a Bristo wrench may be inserted in the screw securing the left half of the Oldham coupler to the shaft. Loosen the clamp on the left half of the coupler, and slide it back on the shaft.

c. Loosen the four red-head captive screws securing the SMO to the chassis. Pull the module from the chassis.

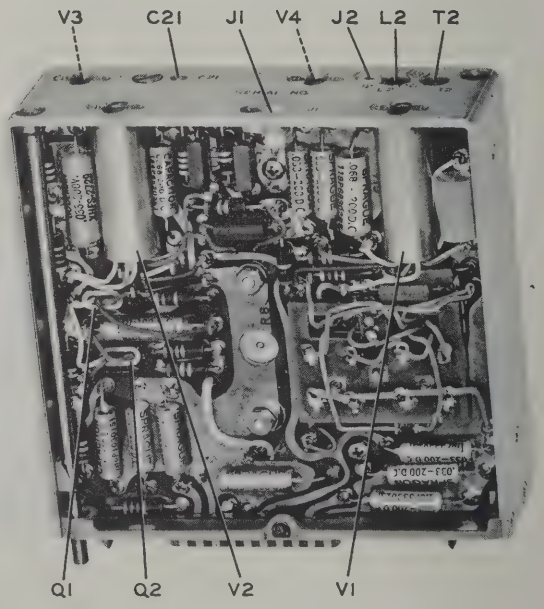


Figure 3-6. Sidestep Oscillator Alignment Points

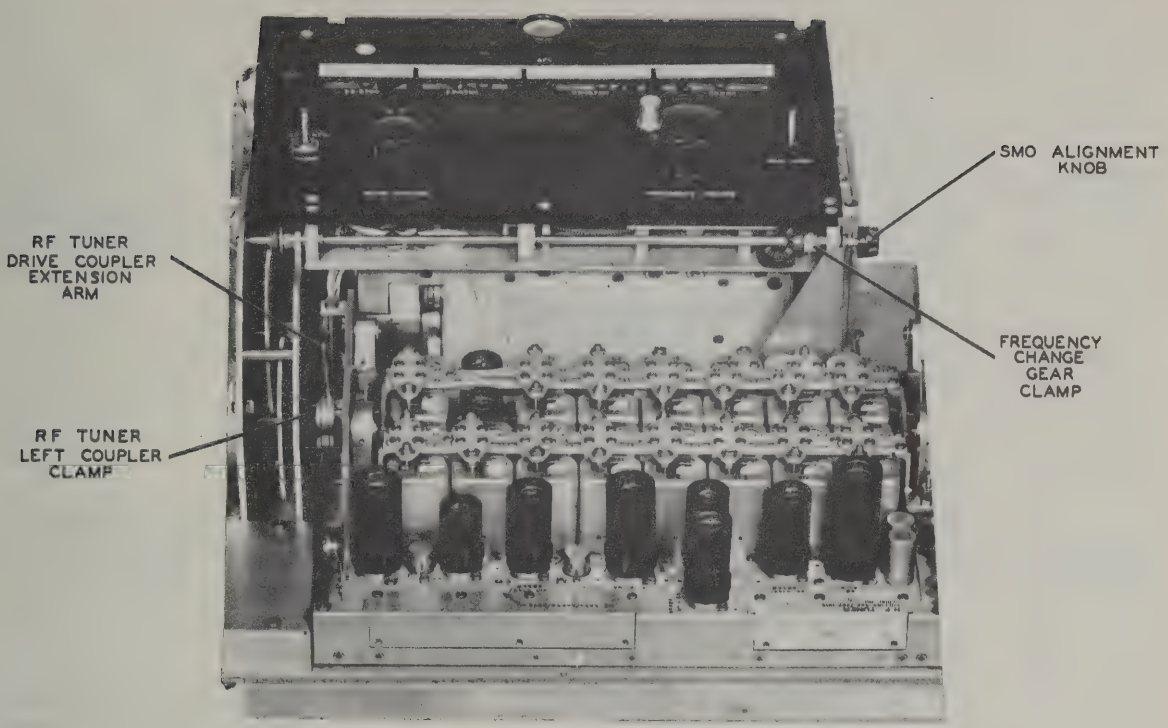


Figure 3-7. Frequency Change Drive Adjustments

NOTE

The following procedure is used to replace the SMO and accurately position the mechanical drive shaft with respect to the Frequency Generator 786E-1 dial frequency. The procedure does not require the use of external equipment. If an accurately calibrated receiver or frequency counter is available, the SMO frequency may be monitored directly and aligned with the dial using the same procedure (the SMO frequency is used to position on instead of the converted audio signal). The SMO frequency is placed 300 kc higher than the band 1 dial reading.

d. To replace the SMO module, rotate the coupler (on SMO) clockwise to the low-frequency stop. Rotate the coupler counterclockwise exactly 57 turns. This places the SMO output frequency at approximately 2700 kc.

e. Set BAND CHANGE control to BAND 1. Set the dial frequency of band 1 to 2400. The band 4 dial reads 21.300 mc. Align the white line at the center of the last digit on band 4 with the white line at the center of the window.

f. Lower the control panel. Plug the SMO into position, and tighten the four captive screws

g. Engage the Oldham couplers and tighten to shaft. Raise front panel and secure.

h. Loosen gear clamp at lower right-hand corner of hinged control panel (see figure 3-7). It may be necessary to turn FREQUENCY CHANGE knob to allow access to screw head on gear clamp. If necessary, return to original frequency setting of step e, after loosening clamp.

i. Apply power to equipment. Loosely couple the Frequency Generator 786E-1 receiver input (J11 at rear) to J1 on the Sidestep Oscillator module (2.400-mc source). Loosen left coupler clamp on R-F Tuner module. R-F Tuner module must be setting at a position to pass the 2.400-mc signal. If not, rotate tuner shaft with extended arm until noise is heard in the audio output.

j. While listening to the audio output on either sideband, turn SMO alignment knob (lower right-hand corner of hinged panel) until zero beat is obtained. Tighten screw on the gear clamp.

k. Listening to LSB audio output, increase frequency dial setting from original position until a beat note is heard. Note distance of movement of the last digit in the band 4 window. Return to original position. Listen to the USB audio output, and decrease frequency dial setting until a beat note is heard and note

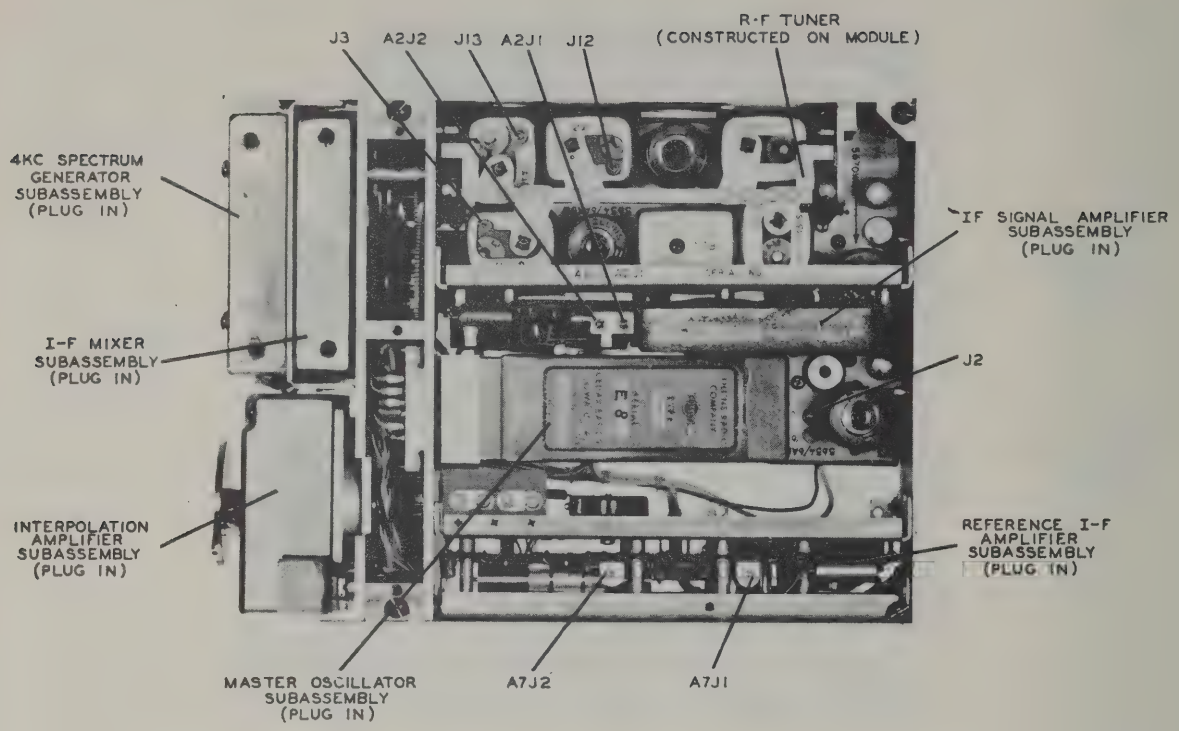


Figure 3-8. SMO Alignment Points and Subassembly Location

the distance of movement as above. The distance of movement should be equal for each position. If not, repeat step j.

l. SMO replacement is now complete. Refer to R-F Tuner replacement section, paragraph 3.4.2.1, for final positioning of R-F Tuner module.

3.4.6.2 INTERPOLATION OSCILLATOR AND MASTER OSCILLATOR SUBASSEMBLIES; REMOVAL, REPLACEMENT, AND ALIGNMENT. (Refer to figure 3-8 for SMO subassembly locations.)

a. Remove SMO module as per paragraph 3.4.6.1. Remove shield cover from left end of module.

b. Turn the interpolation oscillator (IO) coupler clockwise to the low-frequency end stop.

c. Loosen the two captive screws in the IO.

d. Leave J7 and A5P1 connected, and carefully pull the IO subassembly out.

e. Move the IO to one side, but *do not* allow to dangle on cable.

f. If the IO is to be replaced, unlace its two coaxial leads from the cable, and unsolder them from jacks J5 and J8. Disconnect A5P1 from J7. Be careful not to twist plug pins; this may damage plug. Use a small flat-blade screwdriver, and gently pry the plug and jack apart.

g. If tne master oscillator (MO) is to be removed, remove the gear support tool (secured by two screws in the upper right-hand corner of the SMO), and insert it into the large hole in the gear plate opposite the MO shaft end. Align the two small wing clips on the tool with the hole notches in the gear plate, insert, and turn to lock. The small end of the plunger should be pressed against the MO shaft end. This gear support tool holds the MO shaft gear meshed with the gear train to prevent misalignment of end-stop adjustment.

h. Loosen the Bristo screw in the MO shaft gear clamp. Remove the two Phillips screws (securing the MO to the gear plate) by inserting the screwdriver through access holes in the gear plate. Remove V3. Remove the master oscillator, making certain the plunger of gear support tool enters MO shaft gear hub as MO shaft is pulled out.

CAUTION

The MO cover is a special material. Do not drop or strike the cover as this may destroy its shielding properties.

i. Check the end stops of the SMO by moving the slug rack to both ends of its travel. *Do not force.* The cam rider on the end-stop cam must be equidistant from the peak of the cam contour at each end of travel.

If necessary, adjust the end-stop wing. This can be done by removing MO shaft gear and adjusting the gear attached to the end-stop wing. Replace the MO shaft gear, and recheck end stops as above.

j. To replace the MO, insert the shaft through the hole in the gear plate, and mate the plug and jack. Hold in place with the shaft end, pressing the spring-loaded plunger of the gear support tool, and remove the gear support tool.

k. Secure the MO to the gear plate with two screws. Do not tighten gear clamp at this time.

CAUTION

Do not turn master oscillator shaft manually before assembling to SMO. If this shaft is turned through its end point, the MO may be damaged permanently.

l. Connect the SMO to the chassis through an extension cable, and apply power to the 786E-1. Short A2J2 to ground.

m. Allow a five-minute warmup. Connect Hewlett-Packard 410B VTVM (with r-f probe) to J13.

n. Manually move the r-f tuner subassembly slug rack through its range, and leave at position which produces maximum indication on the vtvm.

o. Tighten clamp on MO shaft.

p. Using fingers, turn gear train so MO shaft moves in clockwise direction until gear train reaches end stop. Check the MO frequency on communications receiver by clipping antenna lead to slug rack or loosely coupling to J13. The MO frequency should be 1990 kc ±5 kc.

q. If MO frequency is more than 1995 or less than 1985 kc, loosen the MO shaft clamp, and adjust to 1990 kc with screwdriver in slotted end of MO shaft. Retighten shaft clamp.

r. Temporarily replace the IO subassembly, taking care to mesh gears and align plug pins properly. Tighten captive screws on IO.

s. Turn coupler, on IO shaft, until MO frequency is 2.000 mc. Mark matching index points on the coupler and IO cover, and turn coupler counterclockwise *exactly* 160 turns. The MO frequency should be 4.0 mc. If not, adjust A1L2 (trimmer adjustment hole in gear plate end of MO can).

t. Recheck MO frequency at 2.0 mc by turning coupler *exactly* 160 turns clockwise. If MO frequency is not 2.0 mc, loosen MO shaft gear, and adjust MO shaft for 2.0 mc. (For small adjustments, this may be done by inserting small shaft screwdriver between gear plates and into side of slotted shaft.)

u. Repeat steps s and t until MO frequency range is exactly 2.000 mc with exactly 160 rotations of the IO shaft coupler.

v. Set MO at 2.0 mc.

w. Insert a piece of insulated wire into one of the holes in the IO cover, and clip the communications receiver antenna to outside of insulation. Determine the IO frequency by tuning the receiver from 549.4 to 645.4 kc. With the MO at 2.0 mc, the desired IO frequency is 645.4 kc.

x. If IO is not at 645.4 kc, move the IO to one side, disengaging gears, and increase frequency by turning coupler clockwise 15 degrees for each 4 kc of frequency displacement from the 645.4-kc point. For example, if IO frequency is 585.4 kc, the frequency displacement is 60 kc, or fifteen 4-kc increments. This requires 15 degrees x 15 increments, or 225 degrees of clockwise rotation of shaft.

y. The interpolation oscillator frequency should now be 645.4 kc with MO set at 2.000 mc. Make a pencil mark on the coupler, and rotate the coupler in both directions to the point where the oscillator frequency changes (as noted in receiver). Make a pencil mark on the interpolation oscillator cover corresponding to a mark on the coupler at each of these points, and then set the coupler to a point midway between these points. Move the interpolation oscillator back into its original position, check that the gears are engaged, and tighten the captive screws. Remove short from A2J2.

z. Turn SMO through its frequency range (2-4 mc) observing AFC meter on front panel of Frequency Generator 786E-1. Note the amount of deflection of the meter from zero (center scale). If the IO is sitting in the proper position with respect to the MO, the average deflection either side of zero should be equal across the band. If the average deflection is concentrated to one side or the other, the MO should be disengaged by loosening MO shaft gear. Turn shaft of MO slightly (as in ±) in the direction that causes the AFC meter to move in the direction for balance. That is, if the average deflection is concentrated to the right, turn the MO shaft so that the meter deflection moves to the left. Tighten MO shaft gear clamp and recheck AFC deflection across band. If the AFC meter pointer deflects full scale, the IO may not be sitting on the proper pad, and the procedure for installing the IO should be repeated. If at any point across the frequency range of the SMO, the AFC meter indicates 80 microamperes or more, loosely couple a communications receiver to the SMO output (J13). Turn the IO shaft to change the SMO frequency. Distinct frequency steps should be heard (500-cps increments). If the steps are not distinct or tend to warble, this indicates that the SMO is not phase locking at this point. Loosen MO shaft gear clamp, and turn MO in a direction to decrease reading of AFC meter a few microamperes. Tighten clamp and listen to SMO output around this point again. Repeat until distinct 500-cps steps are heard in the SMO output. Recheck the AFC meter excursions across the rest of the band.

NOTE

The procedure is complete at this point unless the IO is to be aligned. If the IO is to be aligned in the field, a precise frequency measuring device, such as Hewlett-Packard 524B Electronic Counter, is required to adjust frequencies to within ±100 cycles per second.

aa. Monitor the IO frequencies in a communications receiver to determine when the next pad is switched into the circuit in the following procedure. Connect the frequency counter to pin F of J8. Short A2J2 to ground.

ab. Remove the IO shaft coupler from shaft. Turn the IO shaft counterclockwise to lower the frequency. Set the IO at 645.4, 641.4, 637.4, 633.4, and 629.4 kc ±100 cps, and record the frequencies of the frequency counter. If the error at 645.4 kc is more or less than that at 629.4 kc, adjust A5L2 (through hole A in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 637.4 kc.

ac. Check the IO frequency for 625.4, 621.4, 617.4, 613.4, and 609.4 kc ±100 cps. If the error at 625.4 kc differs from that at 609.4 kc, adjust A5L7 (through hole B in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 617.4 kc.

ad. Check the IO frequency for 605.4, 601.4, 597.4, 593.4, and 589.4 kc ±100 cps. If the error at 605.4 kc differs from that at 589.4 kc, adjust A5L12 (through hole C in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 597.4 kc.

ae. Check the IO frequency for 585.4, 581.4, 577.4, 573.4, and 569.4 kc ±100 cps. If the error at 585.4 kc differs from that at 569.4 kc, adjust A5L17 (through hole D in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 577.4 kc.

af. Check the interpolation oscillator frequency for 565.4, 561.4, 557.4, 553.4, and 549.4 kc ±100 cps. If the error at 565.4 kc differs from that at 549.4 kc, adjust A5L22 (through hole E in the IO cover) to divide the error evenly between these two points. Near zero error should occur at 557.4 kc.

ag. Recheck the IO frequency at 645.4 kc; remove short from A2J2 to ground.

3.4.6.3 R-F TUNER SUBASSEMBLY ALIGNMENT. If complete alignment is necessary, remove SMO from chassis, and connect through extension cable.

a. Turn SMO coupler (in IO shaft) clockwise to the low end stop. Check that the r-f tuner subassembly rack post on the underside of the SMO module is set about 1/16 of an inch from the bottom of the SMO chassis. If not, loosen clamp (between gear plates) on gear, driving the rack and place in this position. Tighten clamp.

b. Couple communications receiver loosely to J13, and set MO to 2.206 mc using communications receiver as frequency monitor.

NOTE

An alignment tool is provided in the SMO. The brass end is for alignment of FL1 of r-f tuner subassembly. The plastic end is for alignment of all other transformers and filters.

c. Short A2J2 to ground and place a-c vtvm at J13. Set R-F Tuner module (not r-f tuner subassembly) to 1.906 mc. Adjust Z1 for maximum reading (1.9 to 3 volts rms).

d. Connect d-c vtvm at J2, and adjust L3 for maximum negative indication.

e. Couple communications receiver to pin 1 of V2 at a frequency of 21.1 mc. Tune Z4 and Z5 for maximum signal on communications receiver.

f. Place 400D vtvm at J4 pin A; adjust slugs of Z2 and Z3 for maximum a-c indication. Touch up L3 and slugs of Z4 and Z5 for maximum a-c indication.

g. If FL1 (of this subassembly) has been replaced, peak FL1 input and output adjustments (located on bottom of chassis below XV2).

h. Set MO frequency to 3.806 mc. Set R-F Tuner module to 3.506 mc, and adjust trimmer capacitor of Z1 for maximum a-c indication at J13. Adjust trimmers of Z2, Z3, Z4, and Z5 for maximum a-c indication at J4 pin A.

NOTE

The R-F Tuner module must be set 300 kc below SMO frequency in order to align Z1, only. The remaining alignment points are independent of R-F Tuner module setting.

i. The above steps may have to be repeated to obtain proper tracking across the band.

j. Remove meters. The r-f tuner subassembly is now aligned.

3.4.6.4. I-F MIXERS SUBASSEMBLY ALIGNMENT (MODEL A AND MODEL B SMO). Remove SMO, and connect through extension cable to chassis. Remove i-f mixers subassembly and connect to SMO through extension board.

a. Connect an a-c vtvm, Hewlett-Packard 400D, to terminal A of J4; adjust A3T1 for maximum indication.

b. Loosely couple the communications receiver to J13 of SMO. Turn interpolation oscillator coupler to produce interpolation oscillator frequency of 573.4 kilocycles as monitored in communications receiver. Adjust the end points of A3FL1 (by selection of A3C5) for maximum a-c indication on the vtvm.

c. Remove meter. Replace i-f mixers subassembly and SMO.

3.4.6.5. I-F MIXER SUBASSEMBLY ALIGNMENT (MODEL C SMO). Remove SMO and connect through extension cable to chassis. Remove i-f mixer subassembly and connect to SMO through extension board.

a. Connect an a-c vtvm, Hewlett-Packard 400D, to terminal A of J4 on signal i-f amplifier subassembly.

b. Adjust A3T1 for maximum indication on the vtvm. Remove meter.

c. Replace i-f mixers subassembly and SMO.

3.4.6.6 FOUR-KILOCYCLE SPECTRUM GENERATOR ALIGNMENT. Loosely couple communications receiver antenna to J13 of SMO.

a. Connect a d-c vtvm to A7J2 (see figure 3-8) in the reference i-f amplifier board, set the IO frequency to 645.4 kc (monitored in communications receiver), and adjust A6T1 for minimum voltage at A7J2.
b. Set the IO frequency to 549.4 kc, and adjust A6T1 for minimum voltage at A7J2.
c. Repeat steps a and b until the voltage indications are within 10 percent of each other.

3.4.6.7 REFERENCE I-F AMPLIFIER SUBASSEMBLY ALIGNMENT.

a. Disconnect the coaxial leads at terminals B and C of J9, and inject a 455-kc signal from a signal generator through a series 22K resistor.
b. Connect a d-c vtvm to A7J2 (see figure 3-8) and increase the amplitude of injection signal until the agc voltage at A7J2 starts to decrease (point of agc threshold).
c. Using the nonmetallic end of the alignment tool, adjust A7T1, A7L2, and A7T2 for a dip in agc voltage. As each transformer is tuned, decrease the amplitude of the injection signal so that tuning adjustments are made just above agc threshold.

NOTE

There are two possible tuning points on each transformer. Use the tuning point with the slug farthest into the coil.

3.4.6.8 SIGNAL I-F AMPLIFIER SUBASSEMBLY ALIGNMENT (MODEL A SMO). Remove signal i-f amplifier subassembly, and connect to SMO through extension board. To remove the subassembly, swing out the unit directly above the 786E-1, and insert a Phillips screwdriver through the access holes at the top of SMO module to remove the screws holding the signal i-f amplifier board. The screw on the far right of the board can be removed with an offset Phillips screwdriver.

a. Remove the straps across E1-E2 and E3-E4 on SMO module and insert a 0-25 d-c milliammeter in each location. Connect the positive terminals of the meters to E1 and E3. Unsolder the leads to AFC meter on front panel of 786E-1 and connect a 0-1 milliampere, zero-center milliammeter in its place to act as a differential meter. Connect vtvm for d-c operation at A2J2 of signal i-f amplifier subassembly. Unsolder coaxial lead from pin L of J4, and short pin L to ground.
b. Disconnect the coaxial cable at terminal A of J4 (or remove i-f mixers subassembly), and inject a 455-kc ±50-cps signal from Measurements Corporation 65B Signal Generator through a series connected 1000-ohm resistor and 0.1-uf capacitor. To obtain this degree of accuracy, signal generator must be calibrated against a known standard. Adjust level of injected signal to a value that causes a slight decrease in agc voltage at A2J2 (point of agc threshold) and output current indication appears on the output meters.
c. Adjust A2R3 for mechanical center. Make sure that the oven has been on for at least five minutes, remove oven cover, adjust A2L1 for minimum indication on the meter across E1-E2, and adjust A2L2 for minimum on the meter across E3-E4. Repeat these adjustments twice.
d. Recheck the agc voltage, and if necessary, adjust the level of the injected signal to bring the agc voltage to just below threshold.
e. Adjust A2T1, A2T2, A2T3, and A2L3 for minimum agc voltage. Repeat at least once; then repeat adjustment of A2L1 and A2L2 in step c.
f. Change the injection frequency to 465 kc, and adjust the level to obtain an indication on the meters across E1-E2 and E3-E4.
g. Adjust A2L1 for maximum on the output meter across E3-E4. Adjust the injection level to keep this maximum below 8.0 milliamperes.
h. Change the injection frequency to 445 kc, and adjust A2L2 for maximum on the output meter across E1-E2. Adjust the injection level to keep this maximum below 8.0 milliamperes.
i. Repeat steps f, g, and h at least twice.
j. Set the injection frequency to 455 kc ±50 cps at a level of 10,000 microvolts. Adjust A2R3 for equal currents in the output meters across E1-E2 and E3-E4. Use the zero-center meter connected in place of the AFC meter for the final adjustment of A2R3. The resulting currents on the output meters should be not more than seven milliamperes with the injection level set at 100,000 microvolts and not less than four milliamperes with the injection level set at 1000 microvolts. If the final currents (at balance) for 100,000 microvolts are greater than 7.0 ma, the tuning frequencies in steps f and h must be moved closer to 455 kc (447 and 463 kc) and the tuning procedure repeated until the final currents at balance are within the limits specified. Similarly, if the currents at balance for 1000 microvolts are less than 4 ma, the tuning frequencies must be moved farther from 455 kc (443 and 467 kc) and the tuning procedure repeated until the currents at balance are within the limits specified.
k. Set injection to 457 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes between the two 0-25 milliammeters. Set injection to 453 kc at a level of 10,000 microvolts. Check for a difference reading of no less than 4 milliamperes. If difference of 4 milliamperes cannot be obtained, repeat steps f, g, and h with tuning frequency moved closer to 455 kc (447 kc and 463 kc).

NOTE

There may be two possible tuning points on A2L1 and A2L2; use the tuning point with the slug farthest in from the top of the can.

1. Remove power from Frequency Generator 786E-1 and remove the test meters. Replace jumpers on E1-E2 and E3-E4, and reconnect the AFC meter. Replace oven cover, and replace signal i-f amplifier subassembly in the SMO. Remove short from pin L of J4, and

reconnect coaxial lead to pin L. Replace coaxial lead connection to pin A of J4 (replace i-f mixers subassembly).

3.4.6.9 SIGNAL I-F AMPLIFIER SUBASSEMBLY ALIGNMENT (MODEL B AND MODEL C SMO). Remove signal i-f amplifier subassembly and connect to SMO through extension board. To remove the subassembly, swing out the unit directly above the 786E-1, and insert a Phillips screwdriver through the access holes at the top of the SMO module to remove the screws holding the signal i-f amplifier board. The screw on the far right of the board can be removed with an offset Phillips screwdriver.

a. Remove i-f mixers subassembly. Connect a d-c vtvm across resistor A2R25.

b. Disconnect the coaxial cable at terminal A of J4, and insert a 462.5-kc ±50-cps signal at 10 mv output from Measurements Corporation 65B Signal Generator through a series-connected 1000-ohm resistor and 0.1-uf capacitor. Short A7J1 test jack to ground to disable the reference i-f amplifier input to the discriminator. To obtain this degree of accuracy, signal generator must be calibrated against a known standard. Adjust A2L1 for a maximum reading on d-c vtvm.

c. Set the frequency of signal generator to 447.5 kc at 10 mv output; check against a known standard. Disconnect a d-c vtvm from A2R25 and connect across A2R26. Adjust A2L2 for a maximum indication on d-c vtvm.

d. Repeat adjustments of A2L1 and A2L2 at least once.

NOTE

When performing steps e and f, note which coil adjustment produces the highest reading on the d-c vtvm.

e. Set frequency of signal generator to 462.5 kc at 10 mv output, and check against a known standard. Connect d-c vtvm across A2R26, and adjust A2L1 for maximum reading on d-c vtvm.

f. Set frequency of signal generator to 447.5 at 10 mv output, and check against a known standard. Adjust A2L2 for maximum reading.

g. Set frequency of signal generator to 455 kc at 10 mv output, and check against a known frequency standard. The reading on the d-c vtvm should be zero. If d-c vtvm indicates unbalance, adjust signal generator frequency until balance is obtained (zero on d-c vtvm). Check signal generator frequency at point of balance. The frequency of signal generator should be no more than plus 100 cps or minus 50 cps from 455 kc. If frequency unbalance exceeds above limits, reset frequency of signal generator to 455 kc at 10 mv output, and check against a known standard. Readjust A2L1 or A2L2, whichever had produced the higher d-c vtvm reading in steps e and f, for a maximum indication.

h. Set signal generator frequency at 455 kc at 10 mv output through the 1000-ohm resistor and 0.1-uf capacitor to test jack A7J1 on the reference i-f amplifier board. Short A2J3 to chassis ground to disable signal i-f amplifier board. Connect d-c vtvm across A2R28 and A2R29. Adjust A2T4 for balance (zero) as indicated on d-c vtvm.

i. Resistor A2R24 is selected to set gain of signal i-f amplifier for 1 volt rms output as measured at test jack A2J1 with an input signal of 5 microvolts. Remove R2R24 and replace with a 100-ohm potentiometer adjusted to maximum resistance. Set signal generator to 455 kc, reduce output to agc threshold, and check tuning of T3 as indicated by minumum agc voltage at test jack A2J2. Reduce signal generator output to 5 microvolts, and adjust potentiometer for an output of 1 volt rms at test jack A2J1. Remove and measure potentiometer, and select a resistor for A2R24 equal to or slightly higher than that measured.

j. Replace i-f mixers subassembly. Remove all meters and all grounds applied in the procedure. Replace signal i-f amplifier subassembly.

3.4.6.10 AFC METER AMPLIFIER SUBASSEMBLY METER BALANCE ADJUSTMENT (MODEL B AND MODEL C SMO).

a. Loosen the two captive screws, and lower the front panel of Frequency Generator 786E-1; connect a wire or test lead from test jack A7J2 of the stabilized master oscillator to the chassis. Connect another wire or test lead from test jack A2J2 of the stabilized master oscillator to the chassis.

b. Adjust A8R1 until AFC meter reads center scale (zero reading).

c. Remove the wire or test lead from test jacks A2J2 and A7J2.

d. Swing front panel into position, and secure with the two captive screws.

SECTION IV
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	FREQUENCY GENERATOR 786E-1, MAIN CHASSIS	522-0860-00
C1 thru C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 vdc 1000 uuf +80% -20%	913-1292-00
C20	NOT USED	
C21	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 vdc working; 220,000 uuf ±20%	241-0086-00
C22	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C23	CAPACITOR, FIXED, PAPER DIELECTRIC: 300 vdc working; 100,000 uuf ±20%	241-0087-00
C24	NOT USED	
C25 & C26	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C27	DELETED	
C28	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C29	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C30	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C31	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C32	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C33	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C34	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 vdc, 330,000 uuf ±10%	931-9100-00
C35	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C36	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C37	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C38	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C23	241-0087-00
C39	DELETED	
C40	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	241-0086-00
C41	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 vdc working; 20,000 uuf +100 -20%	913-2142-00
C42	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C41	913-2142-00
C43	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C34	931-9100-00
C44	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C41	913-2142-00
C45	CAPACITOR, FIXED, PLASTIC COATED, SILVER MICA: 500 v dc working .02 uf ±5%	912-2747-00
DS1 thru DS4	LAMP, INCANDESCENT: 28 v, 0.04 amp	262-0179-00
DS5	DIAL BAND SWITCH: aluminum, 0.311 in. ID 3 in. OD	543-3152-002
E1 thru E4	LENS, INDICATOR LIGHT: 0.531 in. dia, plastic, colorless	262-0604-00
E5 thru E11	TERMINAL, STUD: brass, hot tinned dipped, 17/32 in. by 7/32 in.	306-0233-00
E12	DELETED	
E13	TERMINAL, STUD: brass, hot tinned dipped, 3/8 in. by 3/32 in.	306-0234-00
E14	TERMINAL, STUD: same as E13	306-0234-00
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 rd female contacts; 1700 v dc, 1200 v ac, 5 amps; straight	371-0043-00
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts; 5 amps; 1700 v dc, 1200 v ac, 60 cps; straight	371-0041-00
J3	CONNECTOR, RECEPTACLE, ELECTRICAL: 10 flat male contacts; 5,400 v dc, 5 amps; straight	372-1582-00
J4	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J3	372-1582-00
J5	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J3	372-1582-00
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J3	372-1582-00
J7	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J1	371-0043-00
J8	NOT USED	
J9	NOT USED	
J10	CONNECTOR, RECEPTACLE, ELECTRICAL: type BNC female connector, brass	357-9183-00
J11 thru J15	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J10	357-9183-00
J16	CONNECTOR, RECEPTACLE, ELECTRICAL: low loss plastic dielectric, 16 female contacts, 5 amp at 600 v dc	372-1263-00
J17	CONNECTOR, RECEPTACLE, ELECTRICAL: low loss plastic dielectric, 16 female contacts, 5 amp at 600 v dc	372-1261-00
K1	RELAY, ARMATURE: contact arrangement 2A, 1B, contact rating 250 ma at 28 v dc	974-0595-00
L1	COIL, RADIO FREQUENCY: toroidal wound; no. 32 AWG; 72 mh, 14.4 ohms	240-0272-00
L2	NOT USED	
L3	COIL, RADIO FREQUENCY: universal wound, 4 pi, 139 turns #36 AWG ea section, 2.0 mh, 50K ohms, 100 ma	240-0134-00
L4	COIL, RADIO FREQUENCY: single layer wound; magnet wire; 39.0 uh	240-0189-00
L5	COIL, RADIO FREQUENCY: same as L3	240-0134-00
L6	COIL, RADIO FREQUENCY: same as L4	240-0189-00
L7	COIL, RADIO FREQUENCY: same as L4	240-0189-00
L8	COIL, RADIO FREQUENCY: same as L3	240-0134-00
L9	COIL, RADIO FREQUENCY: same as L4	240-0189-00
L10	COIL, RADIO FREQUENCY: same as L4	240-0189-00
L11	COIL, RADIO FREQUENCY: same as L3	240-0134-00
L12	COIL, RADIO FREQUENCY: single layer wound; magnet wire; 120 uh, 4 ohms, max dc, 500 ma	240-0194-00
L13	COIL, RADIO FREQUENCY: same as L12	240-0194-00
L14	NOT USED	
L15	NOT USED	
L16	NOT USED	
L17	COIL, RADIO FREQUENCY: toroidal wound; no. 32 AWG; 72 mh, 1414 ohms	240-0272-00
M1	AMMETER: 100-0-100 ua scale, ±3% deflection; markings and pointer black on white background	458-0424-00
M2	COUNTER, ROTATING, FIXED MOUNTING: 2 banks of 5 figures, 2 banks of 4 figures; nonresetting; ccw rotation	015-0681-00
MP1	SHAFT: CRES; 0.1865 in. dia by 1.163 in. lg overall; one end tapped, other end slotted	543-3163-002
MP2	BEARING, SLEEVE: bronze; flanged; 0.251 in. id, 0.359 in. od, 0.130 in. lg; 0.471 in. od by 0.033 in. w flange	309-0124-00
MP3	BEARING, SLEEVE: bronze, flanged, 0.1885 in. ID, 0.3595 in. OD, 0.125 in. lg	309-0125-00
MP4	BEARING, SLEEVE: same as MP2	309-0124-00
MP5	BEARING, BALL, ANNULAR: single row; radial; 0.422 in. od, 0.1875 in. id, 0.1250 in. thk	309-0661-00
MP6	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP7	HUB, DIAL: CRES; 0.251 in. id, 3/8 in. od, 0.315 in. lg overall; undercut	543-3145-002
MP8	WHEEL, DETENT: CRES; 0.312 in. id countersunk both sides, 1-1/16 in. od; w/8 notches 30° apart	543-3146-002
MP9	SHAFT, SWITCH: CRES; 0.249 in. od by 1-19/32 in. lg; grooved	543-3150-002
MP10	GEAR ASSEMBLY: c/o 2 gears ea w/161 teeth, 20° pressure angle, 3.3541 in. pitch dia, 1 hub and 1 retaining ring	543-3083-002
MP11	BEARING, SLEEVE: same as MP2	309-0124-00
MP12	GEAR ASSEMBLY: c/o 2 gears ea w/90 teeth, 20° pressure angle, 1.8750 in. pitch dia, 1 gear w/36 teeth, 20° pressure angle, 0.750 in. pitch dia, 2 bearings, 1 shim, 1 retaining ring and 2 springs (incl MP13 thru MP16)	543-3100-002
MP13	BEARING, SLEEVE: bronze; 0.183 in. id, 0.318 in. od body; 0.255 in. lg; 0.380 in. dia by 0.064 in. w flange (p/o MP12)	309-0077-00
MP14	BEARING, SLEEVE: same as MP13 (p/o MP12)	309-0077-00
MP15	SPRING, HELICAL, EXTENSION: music wire, 0.020 in. dia, 0.090 in. id, 0.130 in. od (p/o MP12)	506-2068-002
MP16	SPRING, HELICAL, EXTENSION: same as MP15 (p/o MP12)	506-2068-002
MP17	GEAR, SPUR: CRES gear w/180 teeth, 20° pressure angle, 3.750 in. pitch dia; incl steel hub	543-3102-002
MP18	GEAR ASSEMBLY: incl 1 gear w/16 teeth, 0.3333 in. pitch dia and 1 gear w/17 teeth, 0.3541 in. pitch dia, both w/20° pressure angle	543-3103-002
MP19	SPRING, HELICAL, EXTENSION: CRES wire, 0.022 in. dia; 0.112 in. id, 0.156 in. od, 0.3375 free lg	543-3080-002

ITEM	DESCRIPTION	COLLINS PART NUMBER
MP20	DELETED	
MP21	PLATE, AIR DUCT: aluminum, chromate dip, 0.063 in. thk by 3-1/2 in. w by 9/16 in. h, 10.375 in. lg	543-7584-004
MP22	SHAFT: CRES; 3/8 in. dia by 0.522 in. lg overall; undercut and grooved; one end tapped	543-3113-002
MP23	GEAR ASSEMBLY: c/o 1 spur gear w/36 teeth, 20° pressure angle, 0.750 in. pitch dia and 1 bevel gear w/16 teeth, 20° pressure angle, 0.500 in. pitch dia (incl MP24)	543-3178-002
MP24	BEARING, SLEEVE: bronze; 0.1885 in. id, 0.251 in. od, 0.255 in. lg (p/o MP23)	309-0027-00
MP25	GEAR, SPUR: plain, CRES 36 teeth, 20 degree pressure angle, 0.7500 pitch dia, 0.250 width of face, 0.3755 in. id (incl MP26)	545-7740-002
MP26	BEARING, BALL, ANNULAR: same as MP5 (p/o MP25)	309-0661-00
MP27	GEAR, SPUR: plain, aluminum alloy gear, 54 teeth, 20 degree pressure angle, 1.1250 in. pitch dia, 0.235 in. w of face, stainless steel, single row radial bearing	545-7743-002
MP28	BEARING, BALL, ANNULAR: single row, radial, 0.1875 in. id, 0.500 in. od, 0.1969 in. w (p/o MP27)	309-0300-00
MP29	ACTUATOR, BRAKE: stainless steel; approx 3/16 in. by 0.3046 in. by 0.8195 in. overall	543-3136-002
MP30	GEAR ASSEMBLY: c/o 2 spur gears ea w/36 teeth, 0.750 in. pitch dia and 1 spur gear w/18 teeth, 0.3750 in. pitch dia, all w/20° pressure angle	543-3162-002
MP31	SPRING, HELICAL, COMPRESSION: music wire, 0.010 in. dia; 0.070 in. id, 0.090 in. od, 9/16 in. free lg	543-3165-002
MP32	SPRING, HELICAL, COMPRESSION: music wire, 0.022 in. dia, 0.331 in. id, 3/8 in. od, 7/16 in. free lg	543-3166-002
MP33	GEAR, SPUR: plain, aluminum alloy, 36 teeth, 20 degree pressure angle, 0.7500 in. pitch dia, 0.235 in. w face, incl stainless steel, single row radial bearing	545-7745-002
MP34	BEARING, BALL, ANNULAR: same as MP28	309-0300-00
MP35	BLOCK, COUPLING: stainless steel; 19/32 in. id, 1-3/4 in. od, 0.156 in. lg; grooved	543-3192-003
MP36	BLOCK, COUPLING: same as MP35	543-3192-003
MP37	COUPLING HALF, SHAFT: CRES; split hub, 0.250 in. dia; 1-3/4 in. dia by 0.374 in. lg	543-3066-002
MP38	COUPLING HALF, SHAFT: stainless steel; split hub, 0.187 in. dia; 1-3/4 in. dia by 0.374 in. lg approx overall; incl 1 groove pin	543-3099-002
MP39	PULLEY, GROOVE: stainless steel; 10 grooves equally spaced 36° apart; incl 1 pulley washer	543-3075-002
MP40	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP41	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP42	BEARING, SLEEVE: bronze; 0.126 in. id, 0.252 in. od, 0.146 in. lg; 0.3150 in. dia by 0.0493 in. w flange	309-0131-00
MP43	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP44	NOT USED	
MP45	BEARING, SLEEVE: same as MP42	309-0131-00
MP46	PULLEY, GROOVE: same as MP39	543-3075-002
MP47	CLAMP, LOOP: aluminum; accommodates 0.250 in. dia material	543-3078-002
MP48	GEAR, SPUR: 18 teeth, 20° pressure angle, 0.375 in. pitch dia	543-3124-002
MP49	SHAFT: stainless steel; 0.1875 in. dia by 1.875 in. lg overall; grooved	543-3128-002
MP50	SPRING, HELICAL, EXTENSION: same as MP15	506-2068-002
MP51	SPRING, HELICAL, EXTENSION: same as MP15	506-2068-002
MP52	GEAR, SPUR: 159 teeth, 20° pressure angle, 3.3125 in. pitch dia, 0.437 in. dia bore	543-3076-002
MP53	HUB: stainless steel; 0.1887 in. dia counterbore to 0.253 in. id, 0.500 in. od, 0.277 in. lg; stepped	543-3122-002
MP54	SHAFT: stainless steel; 0.1872 in. dia by 1.562 in. lg; grooved	543-3125-002
MP55	GEAR, SPUR: 159 teeth, 20° pressure angle, 3.3125 in. pitch dia, 0.250 in. dia bore	543-3131-002
MP56 thru MP59	SPRING, HELICAL, EXTENSION: same as MP15	506-2068-002
MP60	GEAR, SPUR: aluminum; 159 teeth, 20° pressure angle, 3.3125 in. pitch dia	543-3121-002
MP61	GEAR, SPUR: 159 teeth, 20° pressure angle 3.3125 in. pitch dia, 0.287 in. dia bore	543-3077-002
MP62	GEAR, SPUR: same as MP61	543-3077-002
MP63	GEAR, SPUR: 18 teeth, 20° pressure angle, 0.375 in. pitch dia	543-3123-002
MP64	GEAR, SPUR: same as MP63	543-3123-002
MP65	SHAFT: stainless steel; 0.1247 in. dia by 1.250 in. lg overall; 0.866 in. between grooves	543-3126-002
MP66	GEAR, SPUR: 159 teeth, 20° pressure angle, 3.3125 in. pitch dia, 0.2187 in. dia bore	543-3130-002
MP67	SHAFT: stainless steel; 0.1247 in. dia by 1.250 in. lg overall; 0.901 in. between grooves	543-3127-002
MP68	IDLER: c/o shaft, idler lock and retaining ring; approx 1-3/8 in. dia by 29/32 in. lg	543-3087-002
MP69	COUPLING HALF, SHAFT: same as MP38	543-3099-002
MP70	COUPLING HALF, SHAFT: same as MP38	543-3099-002
MP71	CLAMP, LOOP: same as MP47	543-3078-002
MP72	CLAMP, LOOP: same as MP47	543-3078-002
MP73	BEARING, BALL, ANNULAR: single row; radial; 0.422 in. od, 0.1250 in. id, 0.1406 in. thk	309-0660-00
MP74	BEARING, BALL, ANNULAR: same as MP73	309-0660-00
MP75	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP76	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP77	CLAMP, LOOP: same as MP47	543-3078-002
MP78	GEAR, BEVEL: brass, 16 teeth, diametral pitch 32, 20 degree pressure angle, pitch dia 0.5000	543-3138-002
MP79	CLAMP: CRES, type 304, 1/2 in. lg by 0.375 in. w by 0.250 in. dia	544-6037-002
MP80	SPRING, HELICAL, EXTENSION: same as MP15	506-2068-002
MP81	SPRING, HELICAL, EXTENSION: same as MP15	506-2068-002
MP82	BEARING, BALL, ANNULAR: same as MP5	309-0661-00
MP83	TIMING BELT: pitch .187 in., pitch circumference 11.781 in., width .125 in., number of teeth 63	233-0082-00
O1	KNOB: setscrew type, phenolic body, 2-5/16 in. dia	281-0074-00
O2	KNOB: setscrew type, phenolic body, two 10-32 mtg holes spaced 90 degrees apart, 1/4 in. dia shaft	281-0278-00
O3	KNOB: setscrew type, black phenolic body, 3/16 in. dia shaft	281-0318-00
R1 thru R4	RESISTOR, FIXED, COMPOSITION: 470 ohms p/m 10%, 1 w	745-3338-00
R5	RESISTOR, FIXED, COMPOSITION: 15,000 ohms p/m 10%, 1/2 w	745-1401-00
S1	SWITCH SECTION, ROTARY: 2 moving 17 fixed contacts, 2 pole 230 vac, 0.25 amps dc	269-1883-00
S2	SWITCH, TOGGLE: spst, ac-dc, 250 v, 3 amp, 125 v, 6 amp	266-0010-00
XDS1 thru XDS4	LAMPHOLDER: for 6, 14 or 28 vdc bulb	262-0603-00
	FREQUENCY DIVIDER, MODULE A1	542-7697-004
C1	CAPACITOR, FIXED, PAPER DIELECTRIC: 600 v dc working; 2200 uuf ±20%	931-4564-00
C2	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 2400 uuf ±2%	935-5070-00
C3	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 2000 uuf ±2%	912-1931-00
C4	CAPACITOR, FIXED, GLASS DIELECTRIC: 100 v dc working; 13,000 uuf ±2%	935-0353-00
C5	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 7,500 uuf ±2%	935-5105-00
C6	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C1	931-4564-00
C7	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 15,000 uuf ±20%	931-4484-00
C8 thru C11	CAPACITOR, FIXED, GLASS DIELECTRIC: 100 v dc working; 20,000 uuf ±2%	935-0354-00
C12	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 10,000 uuf ±20%	931-4481-00
C13	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 100,000 uuf ±20%	931-4488-00
C14	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C13	931-4488-00
C15	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C13	931-4488-00
C16	CAPACITOR, FIXED, ELECTROLYTIC: 30 v dc working; 10 uf +75% -15%	184-7295-00
CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; type 1N198	353-0160-00
CR2	NOT USED	
CR3 thru CR8	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type 1N457	353-0204-00
J1	JACK, TIP: std phone tip accommodated; teflon insulation	360-0087-00
J2	JACK, TIP: same as J1	360-0087-00
J3	JACK, TIP: same as J1	360-0087-00
L1	COIL, RADIO FREQUENCY: universal wound, 3 pi, 38 AWG; 1 mh, 60 ma	240-0313-00
P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o Frequency Divider, built in	
Q1 thru Q7	TRANSISTOR: silicon; Texas Instrument Co. type 2N117	352-0048-00
R1	RESISTOR, FIXED, COMPOSITION: 2.2 meg ±10%; 1/2 w	745-1492-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R2	RESISTOR, FIXED, COMPOSITION: 5100 ohms ±5%; 1/2 w	745-1382-00
R3	RESISTOR, FIXED, FILM: 4,640 ohms ±1%; 1/4 w	705-7128-00
R4	RESISTOR, FIXED, FILM: 23,700 ohms ±1%; 1/4 w	705-4500-00
R5	RESISTOR, FIXED, FILM: 19,600 ohms ±1%; 1/4 w	705-4501-00
R6	RESISTOR, FIXED, FILM: same as R3	705-7128-00
R7	RESISTOR, FIXED, FILM: same as R3	705-7128-00
R8	RESISTOR, FIXED, FILM: same as R4	705-4500-00
R9	RESISTOR, FIXED, FILM: same as R4	705-4500-00
R10	RESISTOR, FIXED, FILM: same as R3	705-7128-00
R11	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%; 1/2 w	745-1412-00
R12	RESISTOR, FIXED, FILM: same as R3	705-7128-00
R13	RESISTOR, FIXED, FILM: same as R4	705-4500-00
R14	RESISTOR, FIXED, FILM: same as R4	705-4500-00
R15	RESISTOR, FIXED, FILM: same as R3	705-7128-00
R16	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
R17	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%; 1 w	745-3328-00
R18	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±5%; 1/2 w	745-1369-00
T1	TRANSFORMER, PULSE: interstage type 20 v amplitude, 1 usec rise time, 100 kc P.R.F. primary; 1.2 usec rise time, 3 usec pulse width, 6 usec recovery time secondary and tertiary windings; 1 to 1.4 to 1 overall turns ratio	674-3020-00
T2	TRANSFORMER, PULSE: interstage type; 20 v amplitude, 1 usec rise time, 20 kb P.R.F. primary; 1.2 usec rise time, 3 usec pulse width, 20 usec recovery time secondary and tertiary windings; 2 to 1.7 to 1 overall turns ratio	674-3021-00
T3	TRANSFORMER, PULSE: interstage type; 20 v amplitude, 1 usec rise time, 4 kc P.R.F. primary; 1.2 usec rise time, 4 usec pulse width, 100 usec recovery time secondary and tertiary windings; 1.2 to 1 to 1 overall turns ratio	674-3022-00
TB1	PRINTED CIRCUIT: plastic; incl 6 terminals, 78 tubelets and 9 eyelets	542-7699-004
TB2	PRINTED CIRCUIT: plastic; incl 6 terminals, 5 eyelets and 48 tubelets	542-7705-004
Z1	FREQUENCY DIVIDER SUBASSEMBLY: c/o 5 transistors, 5 diodes, 12 resistors, 7 capacitors, 2 transformers, and 1 printed circuit board	542-7700-004
Z2	FREQUENCY DIVIDER SUBASSEMBLY: c/o 1 transformer, 1 choke, 9 capacitors, 2 transistors, 2 diodes, 6 resistors, and 1 circuit board.	542-7706-004
	SIDESTEP OSCILLATOR, MODULE A2	543-1501-004
C1	CAPACITOR, FIXED, MICA: 33 uuf ±5%, 500 vdcw	912-1797-00
C2	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 33,000 uuf ±20%	931-4504-00
C3	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 6800 uuf ±20%	931-9094-00
C4	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 110 uuf ±5%	912-1836-00
C5	CAPACITOR, FIXED, ELECTROLYTIC: 150 v dc working; 1 uf +75% -15%	184-7161-00
C6	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 33,000 uuf ±20%	931-5344-00
C7	CAPACITOR, FIXED, PAPER: 0.033 uf ±20%, 100 vdcw	931-5297-00
C8	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C9	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C3	931-9094-00
C10	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C11	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C12	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C13	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 56 uuf ±5%	912-1815-00
C14	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 68,000 uuf ±20%	931-5345-00
C15	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C16	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 20 uuf ±5%	912-1784-00
C17	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 200 uuf ±5%	912-1854-00
C18	CAPACITOR, FIXED, MICA DIELECTRIC: same as C4	912-1836-00
C19	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C7	931-5297-00
C20	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C3	931-9094-00
C21	CAPACITOR, VARIABLE, GLASS DIELECTRIC: 500 v dc working; 1.0 to 7.5 uuf	922-0390-00
C22	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 68 uuf ±2%	912-1820-00
C23	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C24	CAPACITOR, FIXED, MICA DIELECTRIC: same as C1	912-1797-00
C25	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 150 uuf ±5%	912-1845-00
C26	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 56 uuf ±2%	912-1814-00
C27	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C17	912-1854-00
C28	CAPACITOR, FIXED, PAPER: 10,000 uuf ±20%, 100 v dc	931-9078-00
C29	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C30	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C31	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C6	931-5344-00
C32	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc, 510 uuf ±5%	912-1884-00
E1 thru E4	SHIELD, ELECTRON TUBE: aluminum; 0.465 in. id, 0.495 in. od, 1-7/16 in. lg; incl insert	542-4782-002
FL1	FILTER, BAND PASS: 455-kc frequency; 0.200 kc at 3 db-bandwidth; 23,000 ohms input and output impedance	526-9308-00
J1	JACK, TIP: std phone tip accommodated; teflon insulation	360-0087-00
J2	JACK, TIP: same as J1 (p/o Z1)	360-0087-00
K1	RELAY, ARMATURE: 2C contact arrangement; 250 amps at 24 v dc or 115 v ac resistive; 1 inductive winding, 26.5 v dc, 800 ohms	974-0554-00
K2	RELAY, ARMATURE: same as K1	947-0554-00
L1	COIL, RADIO FREQUENCY: universal wound pi sections; no. 42 AWG; 1 mh, 20 ma	240-0602-00
L2	COIL, RADIO FREQUENCY: toroidal wound; approx 91 turns no. 38 AWG insulated copper wire; 1.945 mc (p/o Z1)	240-0610-00
L3	COIL, RADIO FREQUENCY: same as L1	240-0602-00
Q1	TRANSISTOR: silicon; Texas Instruments Co. part no. J-125	352-0076-00
Q2	TRANSISTOR: same as Q1	352-0076-00
R1	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w	745-1380-00
R2	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%; 1/2 w	745-1415-00
R3	RESISTOR, FIXED, COMPOSITION: 68,000 ohms ±10%; 1/2 w	745-1429-00
R4	RESISTOR, FIXED, COMPOSITION: 330,000 ohms ±10%; 1/2 w	745-1457-00
R5	RESISTOR, FIXED, COMPOSITION: same as R4	745-1457-00
R6	RESISTOR, FIXED, COMPOSITION: 470 ohms ±10%; 1/2 w	745-1338-00
R7	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
R8	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1384-00
R9	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
R10	RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±10%; 1/2 w	745-1436-00
R11	RESISTOR, FIXED, COMPOSITION: same as R3	745-1429-00
R12	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00
R13	RESISTOR, FIXED, COMPOSITION: 56,000 ohms ±10%; 1/2 w	745-1426-00
R14	RESISTOR, FIXED, COMPOSITION: same as R10	745-1436-00
*R15	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
*R15	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%; 1/2 w	745-1412-00
*R15	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1/2 w	745-1422-00
*R15	RESISTOR, FIXED, COMPOSITION: 68,000 ohms ±10%; 1/2 w	745-1429-00
*R15	RESISTOR, FIXED, COMPOSITION: 0.12 megohms ±10%; 1/2 w	745-1440-00
*R15	RESISTOR, FIXED, COMPOSITION: 0.18 megohms ±10%; 1/2 w	745-1447-00
*R15	RESISTOR, FIXED, COMPOSITION: 0.27 megohms ±10%; 1/2 w	745-1454-00

*Selected per operational requirement

ITEM	DESCRIPTION	COLLINS PART NUMBER
*R15	RESISTOR, FIXED, COMPOSITION: 330,000 ±10%; 1/2 w	745-1457-00
*R15	RESISTOR, FIXED, COMPOSITION: 0.47 megohms ±10%; 1/2 w	745-1464-00
*R15	RESISTOR, FIXED, COMPOSITION: 0.56 megohms ±10%; 1/2 w	745-1468-00
*R15	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%; 1/2 w	745-1415-00
R16	RESISTOR, FIXED, COMPOSITION: same as R10	745-1436-00
R17	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%; 1/2 w	745-1412-00
R18	RESISTOR, FIXED, COMPOSITION: same as R6	745-1338-00
R19	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
R20	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 1/2 w	745-1366-00
R21	RESISTOR, FIXED, COMPOSITION: same as R9	745-1387-00
R22	RESISTOR, FIXED, COMPOSITION: 27,000 ohms ±10%; 1/4 w	745-0800-00
T1	TRANSFORMER, RADIO FREQUENCY: 2 windings, 438 turns approx, 140 turns approx, 39 AWG, 455 kc	544-9788-003
T2	TRANSFORMER, RADIO FREQUENCY: 2.4 mc; toroidal wound (p/o Z1)	240-0608-00
TB1	PRINTED CIRCUIT: plastic; incl 26 terminals, 3 eyelets and 64 tubelets	543-2499-003
TB2	PRINTED CIRCUIT: plastic; incl 28 terminals, 1 eyelet and 37 tubelets	544-2618-003
V1 thru V4	ELECTRON TUBE: subminiature pentode; type 5636	255-0324-00
Y1	CRYSTAL UNIT, QUARTZ: 1 plate, 1942.000 kc ±0.0025%; fundamental mode of operation; etched	290-7540-00
Y2	CRYSTAL UNIT, QUARTZ: 1 plate, 1944.00 kc ±0.0025%; fundamental mode of operation; etched	290-7542-00
Y3	CRYSTAL UNIT, QUARTZ: 1 plate, 1943.00 kc ±0.0025%; fundamental mode of operation; etched	290-7541-00
Y4	CRYSTAL UNIT, QUARTZ: 1 plate, 1945.000 kc ±0.0025%; fundamental mode of operation; etched	290-7543-00
XY1	SOCKET ASSEMBLY, CRYSTAL: accommodates four HC-6 type crystal holders and 2 min type relays	292-0180-00
Z1	TRANSFORMER, RADIO FREQUENCY: 2.4 mc; toroidal wound (incl T2, L2, J2)	543-2510-004
Z2	AMPLIFIER SUBASSEMBLY: c/o 1 choke, 2 tubes, 1 coaxial cable, 2 toroid assemblies, 7 resistors, 14 capacitors, and 1 printed circuit board	543-2515-004
Z3	OSCILLATOR SUBASSEMBLY: c/o 1 crystal socket, 1 choke, 2 tubes, 2 transistors, 18 capacitors, 1 board,13 resistors, 1 filter, 2 relays, cable, and hardware	543-2514-004
	STABILIZED MASTER OSCILLATOR, MODULE A3	542-7791-005
C1	NOT USED	
C2	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 15,000 uuf ±20%	931-5641-00
C3	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 8.0 to 75.0 uuf (p/o Z1)	917-1141-00
C4	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 82 uuf ±2% (p/o Z1)	912-1826-00
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 10,000 uuf +100% -20%	913-3159-00
C6	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 22 uuf ±5%	912-1786-00
C7	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 5.0 to 37.5 uuf (p/o Z2)	917-1139-00
C8	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 68 uuf ±2% (p/o Z2)	912-1820-00
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C10	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C11	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 15 uuf ±5% (p/o Z3)	912-1780-00
C12	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 3.0 to 18.0 uuf (p/o Z3)	917-1140-00
C13	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C14	CAPACITOR, FIXED, MICA: 10 uuf ±5%; 500 vdcw (p/o Z3)	912-1776-00
C15	CAPACITOR, FIXED, MICA: 39 uuf ±5%, 500 vdcw	912-1803-00
C16	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C18	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	913-3159-00
C19	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 220,000 uuf ±20%	241-0086-00
C20	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 510 uuf ±2%	912-1883-00
C21	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 100,000 uuf ±20%	931-1644-00
C22	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 2,000 uuf ±10%	912-0304-00
C23	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	931-1644-00
C24	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 470 uuf ±2%	912-1880-00
C25	CAPACITOR, FIXED, MICA DIELECTRIC: same as C24	912-1880-00
C26	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 100,000 uuf ±20%	931-4602-00
C27	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1786-00
C28	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C21	931-1644-00
C29	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 10 uuf ±1 uuf (p/o Z4)	912-0046-00
C30	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 3.0 to 18.0 uuf (p/o Z4)	917-1120-00
C31	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 100,000 uuf ±20%	931-4605-00
C32	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 2.0 uuf ±1/4 uuf	929-0016-00
C33	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1786-00
C34	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C32	929-0016-00
C35	CAPACITOR, FIXED, MICA DIELECTRIC: sams as C29 (p/o Z5)	913-0046-00
C36	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C30 (p/o Z5)	917-1120-00
C37	CAPACITOR, FIXED, PAPER DIELECTRIC: 300 v dc working; 100,000 uuf ±20%	241-0087-00
C38	CAPACITOR, FIXED, MICA DIELECTRIC: same as C22	912-0304-00
C39	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C2	931-5641-00
C40	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 4.7 uf ±20%, 35 v dc	184-7396-00
C41	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 100,000 uuf ±20%	241-0088-00
C42	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C41	241-0088-00
CR1 thru CR6	SEMICONDUCTOR DEVICE, DIODE: silicon; Transitron Electronic Corp. No. 1N251	353-2539-00
CR7	SEMICONDUCTOR DEVICE, DIODE: germanium, type 1N198	353-0160-00
E1	NUT, PLAIN, CLINCH: p/o TB1, built in	
E2	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E3	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E4	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E5	TERMINAL, STUD: tube pin type brass conductor, teflon insulation; 0.172 in. dia by 0.350 in. lg overall	306-0324-00
E6	TERMINAL, STUD: same as E5	306-0324-00
E7 thru E14	NOT USED	
E15	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6550-003
E16	SHIELD, ELECTRON TUBE: 9 pin noval; brass incl copper insert	541-6553-003
E17	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6551-003
E18	SHIELD, ELECTRON TUBE: same as E15	541-6550-003
E19	INSERT, ELECTRON TUBE SHIELD: cadmium plated copper; w/ 7 tabs bent 40°	541-6532-003
E20	INSERT, ELECTRON TUBE SHIELD: same as E19	541-6532-003
E21	INSERT, ELECTRON TUBE SHIELD: same as E19	541-6532-003
E22	INSERT, ELECTRON TUBE SHIELD: cadmium plated copper; w/ 8 tabs bent 40°	541-6533-003
E23 thru E27	CORE, ADJUSTABLE TUNING: powdered iron; permeability 61 at 1 mc; .5- to 32-mc frequency range	288-2111-00

*Selected per operational requirement

ITEM	DESCRIPTION	COLLINS PART NUMBER
E28	TERMINAL, STUD: brass; 0.218 in. dia by 0.489 in. lg overall	306-0322-00
E29	TERMINAL, STUD: same as E5 (qty 5)	306-0324-00
E30	JACK, TIP: std phone tip contact element accommodated; plastic insulation (qty 18)	360-0077-00
FL1	FILTER, BAND PASS: 3.37 to 3.53 mc frequency range	543-1781-003
H1	ALIGNMENT TOOL, ELECTRONIC EQUIPMENT: brass bit and plastic holder; 2 working ends	543-1723-002
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 flat female contacts, 10 amp, 2500 v rms; straight (mates w/ A1P1)	372-1601-00
J2	JACK, TIP: std phone tip contact element accommodated; teflon insulation	360-0090-00
J3	JACK, TIP: std phone tip contact element accommodated; teflon insulation (p/o Z2)	360-0129-00
J4	CONNECTOR, RECEPTACLE, ELECTRICAL: 10 female contacts, 5 amp; straight (mates w/ A2P1)	372-1669-00
J5	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A3P1)	372-1669-00
J6	NOT USED	
J7	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 female contacts, 5 amps, 1500 v dc; straight (mates w/ A5P1)	372-1539-00
J8	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A6P1)	372-1669-00
J9	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A7P1)	372-1669-00
J10	NOT USED	
J11	NOT USED	
J12	JACK, TIP: same as J3 (p/o Z3)	360-0129-00
J13	JACK, TIP: same as J3 (p/o Z1)	360-0129-00
L1	COIL, RADIO FREQUENCY: universal wound pi sections; no. 40 AWG; 2.0 mh, 100 uuf, 35 ma	240-0084-00
L2	COIL, RADIO FREQUENCY: single layer wound; 15 turns no. 26 AWG; 16- to 32-mc frequency range (p/o Z3)	543-1691-002
L3	COIL, RADIO FREQUENCY: single layer wound; no. 36 AWG; 6.5 mh	278-0257-00
L4	COIL, RADIO FREQUENCY: single layer wound; 15 turns no. 28 AWG; 19.5- to 35.5-mc frequency range (p/o Z4)	543-1692-002
L5	COIL, RADIO FREQUENCY: same as L4 (p/o Z5)	543-1692-002
L6	COIL, RADIO FREQUENCY: same as L1	240-0084-00
L7	COIL, RADIO FREQUENCY: single layer wound; magnet wire; 39 uh, 0.60 ohms, 1000 ma	240-0189-00
L8	COIL, RADIO FREQUENCY: #38 AWG, toroidal wound, 1000 mh, 3.6 ohms	240-0287-00
MP1	GEAR ASSEMBLY: 2 gears; 1 w/ 135 teeth, 2.8125 in. pitch dia; 1 w/ 22 teeth, 0.4538 in. pitch dia; ea 20° pressure angle (incl MP33)	543-1650-002
MP2	GEAR, SPUR: 30 teeth, 20° pressure angle, 0.6250 in. pitch dia	543-1651-002
MP3	GEAR ASSEMBLY: 2 gears; 1 w/ 52 teeth, 1.0833 in. pitch dia; 1 w/ 22 teeth, 0.3437 in. pitch dia; ea 20° pressure angle; inch arm (incl MP32)	543-1811-002
MP4	NOT USED	
MP5	GEAR ASSEMBLY: 2 gears; 1 w/ 88 teeth, 1.375 in. pitch dia; 1 w/ 18 teeth 0.375 in. pitch dia; ea 20° pressure angle (incl MP35)	543-1646-002
MP6	GEAR, SPUR: 88 teeth, 20° pressure angle, 1.8333 in. pitch dia	543-1655-002
MP7	NOT USED	
MP8	BEARING, BALL, ANNULAR: single row; radial; 0.359 in. od, 0.1875 in. id, 0.125 in. thk	309-0659-00
MP9	SPRING, HELICAL, EXTENSION: stainless steel; wire 0.033 in. dia hook ends; 4-1/2 coils; 0.472 in. overall	542-5381-002
MP10	NOT USED	
MP11	SPRING, HELICAL, EXTENSION: steel music wire; 9/64 in. id, 0.156 in. od, 5/16 in. lg	340-2090-00
MP12	CAM, CONTROL: aluminum anodized; 0.375 in. id, 1.500 in. od, 0.381 in. thk overall	543-1806-002
MP13	PULLEY, FLAT: c/o bearing, pin and liner; 3/4 in. od, 7/64 in. thk approx	543-1688-002
MP14	BEARING, BALL, ANNULAR: single row; radial; 0.625 in. od, 0.25 in. id, 0.196 in. thk	309-1360-00
MP15	SHAFT, DRIVE, FLEXIBLE: 5-5/16 in. lg by 5/8 in. dia overall; incl roller and pin	543-1642-00
MP16	BEARING, BALL, ANNULAR: single row; radial; 0.296 in. od, 0.125 in. id, 0.1094 in. thk	309-0656-00
MP17	BEARING, BALL, ANNULAR: same as MP16	309-0656-00
MP18	BEARING, BALL, ANNULAR: same as MP16	309-0656-00
MP19	BEARING, BALL, ANNULAR: same as MP8	309-0659-00
MP20	NOT USED	
MP21	NOT USED	
MP22	GEAR, GUIDE: c/o plate, spring, pin guide and hardware	543-1737-002
MP23	BEARING, BALL, ANNULAR: same as MP14	309-1360-00
MP24	PULLEY, FLAT: same as MP13	543-1688-002
MP25	SPRING, HELICAL EXTENSION: same as MP9	542-5381-002
MP26	NOT USED	
MP27	BEARING, BALL, ANNULAR: single row; radial; 0.1875 in. id, 0.500 in. od, 0.1969 in. thk	309-0300-00
MP28	BEARING, BALL, ANNULAR: same as MP27	309-0300-00
MP29	HUB: anodized aluminum; grooved; 0.443 in. lg by 3/8 in. dia overall	543-1633-002
MP30	HUB: same as MP29	543-1633-002
MP31	GEAR, SPUR: 22 teeth, 20° pressure angle, 0.4583 in. pitch dia	543-1647-002
MP32	GEAR ASSEMBLY: 2 gears; 1 w/ 52 teeth, 0.0833 in. pitch dia; 1 w/ 22 teeth, 0.3437 in. pitch dia; ea 20° pressure angle (p/o MP3)	543-1648-002
MP33	GEAR, SPUR: 22 teeth, 20° pressure angle, 0.3437 in. pitch dia (p/o MP1)	543-1653-002
MP34	NOT USED	
MP35	GEAR, SPUR: 18 teeth, 20° pressure angle, 0.375 in. pitch dia (p/o MP5)	543-1644-002
MP36	SPRING, HELICAL, COMPRESSION: stainless steel; rh wire 0.018 in. dia; 13 coils; 13/16 in. lg	543-1736-002
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 rd male contacts, 1700 v dc, 5 amps; straight	371-0029-00
R1	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
R2	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1 w	745-3387-00
R3	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 1/2 w	745-1310-00
R4	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00
R5	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1 w	745-3422-00
R6	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-3394-00
R7	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1/2 w	745-1422-00
R8	RESISTOR, FIXED, COMPOSITION: 330 ohms ±10%; 1/2 w	745-1331-00
R9	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%; 1 w	745-3391-00
R10	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
R11	NOT USED	
R12	NOT USED	
R13	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%; 1 w	745-3408-00
R14	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1 w	745-3419-00
R15	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 1/2 w	745-1366-00
R16	RESISTOR, FIXED, COMPOSITION: same as R8	745-1331-00
R17	RESISTOR, FIXED, COMPOSITION: same as R8	745-1331-00
R18	RESISTOR, FIXED, COMPOSITION: same as R15	745-1366-00
R19	RESISTOR, FIXED, COMPOSITION: same as R7	745-1422-00
R20	RESISTOR, FIXED, COMPOSITION: 15 ohms ±10%; 1/2 w	745-1275-00
R21	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
R22	RESISTOR, FIXED, COMPOSITION: same as R4	745-1401-00
R23	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%; 1 w	745-3415-00
R24 thru R27	NOT USED	
R28	RESISTOR, FIXED, COMPOSITION: same as R6	745-1394-00
R29	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
R30	NOT USED	
R31	RESISTOR, FIXED, COMPOSITION: same as R6	745-1394-00
R32	RESISTOR, FIXED, COMPOSITION: 82,000 ohms ±10%; 1/2 w	745-1433-00
T1	COIL, RADIO FREQUENCY: universal wound; 66 turns Litz wire; 2 to 4 mc frequency range (p/o Z1)	543-1753-002
T2	TRANSFORMER, RADIO FREQUENCY: two windings; 2 turns no. 30 AWG, 44 turns no. 32 AWG; 4 to 8 mc frequency range (p/o Z2)	543-1690-002
TB1	TERMINAL BOARD: plastic board; incl 4 terminals (incl E1, E2, E3 and E4, built in)	543-1683-002
TB2	TERMINAL BOARD: plastic board; incl 3 terminals and 3 eyelets	543-1724-002
V1	ELECTRON TUBE: glass envelope; pentode type 5654	253-0001-00
V2	ELECTRON TUBE: glass envelope; pentagrid converter type 5750	253-0007-00
V3	ELECTRON TUBE: same as V1	253-0001-00
V4	ELECTRON TUBE: double triode; type 5670	253-0002-00
XV1	SOCKET, ELECTRON TUBE: 7 pin miniature	220-1291-00
XV2	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00
XV3	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00
XV4	SOCKET, ELECTRON TUBE: 9 pin miniature	220-1293-00
Z1	TUNING UNIT, RADIO FREQUENCY: 2 to 4 mc frequency range (incl T1, C3, C4, J13)	543-1771-003

ITEM	DESCRIPTION	COLLINS PART NUMBER
Z2	TUNING UNIT, RADIO FREQUENCY: 4 to 8 mc frequency range (incl T2, C7, C8, J3)	544-7235-005
Z3	TUNING UNIT, RADIO FREQUENCY: 16 to 32 mc frequency range (incl L2, C11, C12, C14, J12)	544-7236-005
Z4	TUNING UNIT, RADIO FREQUENCY: 19.5 to 35.5 mc frequency range (incl L4, C29, C30)	543-1775-003
Z5	TUNING UNIT, RADIO FREQUENCY: 19.5 to 35.5 mc frequency range (incl L5, C35, C36)	543-1776-003
	Master Oscillator, Module Subassembly A3A1	
**A3A1	FREQUENCY GENERATOR 786E-1, SMO, MASTER OSCILLATOR, 70H-13: 2.0 to 4.0 mc frequency range; 6.3 v ac, 115 v ac, 400 cps, +27.5 v dc, -130 v dc operating voltage; 1-13/32 in. by 3-3/16 in. by 5-1/4 in. overall	522-0617-004
	Signal I-F Amplifier, Module Subassembly A3A2	544-2633-005
A2C1	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 10, 000 uuf ±20%	931-5649-00
A2C2	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C1	931-5649-00
A2C3	CAPACITOR, FIXED, ELECTROLYTIC: 6 v dc working; 60 uf ±20%	184-7370-00
A2C4	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C3	184-7370-00
A2C5	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 2000 uuf ±1%	935-5135-00
A2C6	CAPACITOR, FIXED, MICA DIELECTRIC: same as A2C5	935-5135-00
A2C7	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 15, 000 uuf ±20%	931-4484-00
A2C8	CAPACITOR, FIXED, ELECTROLYTIC: 20 v dc working; 10 uf ±20%	184-7375-00
A2C9	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 200 uuf ±2%	912-1853-00
A2C10	CAPACITOR, FIXED, ELECTROLYTIC: 35 vdcw, 0.068 uf ±20%	184-7405-00
A2C11	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C3	184-7370-00
A2C12	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 33, 000 uuf ±20%	931-5893-00
A2C13	CAPACITOR, FIXED, MICA DIELECTRIC: same as A2C9	912-1853-00
A2C14	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C12	931-5893-00
A2C15	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C12	931-5893-00
A2C16	CAPACITOR, FIXED, MICA DIELECTRIC: same as A2C9	912-1853-00
A2C17	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C12	931-5893-00
A2C18	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 100, 000 uuf ±20%	931-5892-00
A2C19	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C12	931-5893-00
A2C20	CAPACITOR, FIXED, MICA DIELECTRIC: same as A2C9	912-1853-00
A2C21	NOT USED	
A2C22	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A2C12	931-5893-00
A2C23	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C3	184-7370-00
A2C24	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C3	184-7370-00
A2C25	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C3	184-7370-00
A2C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 100 uuf ±5%	913-2916-00
A2C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as A2C26	913-2916-00
A2CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft Co. type HD2160	353-2006-00
A2CR2	SEMICONDUCTOR DEVICE, DIODE: same as A2CR1	353-2006-00
A2CR3	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type HD6006	353-0204-00
A2CR4	SEMICONDUCTOR DEVICE, DIODE: same as A2CR3	353-0204-00

**This is a sealed unit and it is recommended that it be sent back to Collins Radio Company for repair.

ITEM	DESCRIPTION	COLLINS PART NUMBER
A2HR1	OVEN, TUNED CIRCUIT: +75 ±3°C nom oven temp; 28 v dc	543-1731-002
A2J1	JACK, TIP: std phone tip accommodated; teflon insulation	360-0129-00
A2J2	JACK, TIP: same as A2J1	360-0129-00
A2L1	COIL, RADIO FREQUENCY: single layer wound; #36 AWG; 455 kc	278-0256-00
A2L2	COIL, RADIO FREQUENCY: same as A2L1	278-0256-00
A2L3	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc; #36 AWG; tapped	278-0259-00
A2L4	COIL, RADIO FREQUENCY: single layer wound; #36 AWG; 455 kc	278-0255-00
A2P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o Signal I.F., built in (mates w/ J4)	
A2Q1	TRANSISTOR: silicon; Texas Instruments Co. part no. 951	352-0097-00
A2Q2	TRANSISTOR: same as A2Q1	352-0097-00
A2Q3 thru A2Q6	TRANSISTOR: silicon; Texas Instruments Co. part no. J-213	352-0087-00
A2R1	RESISTOR, FIXED, WIRE WOUND: 4 ohms ±5%; 1/4 w	748-9063-00
A2R2	RESISTOR, FIXED, WIRE WOUND: same as A2R1	748-9063-00
A2R3	RESISTOR, VARIABLE: 2500 ohms ±20%; 1/4 w	380-2212-00
A2R4	RESISTOR, FIXED, COMPOSITION: 470 ohms ±10%; 1/2 w	745-1338-00
A2R5	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1384-00
A2R6	RESISTOR, FIXED, COMPOSITION: 180, 000 ohms ±10%; 1/2 w	745-1447-00
A2R7	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms ±10%; 1/2 w	745-1394-00
A2R8	RESISTOR, FIXED, COMPOSITION: same as A2R5	745-1384-00
A2R9	RESISTOR, FIXED, FILM: 4220 ohms ±1%; 1/4 w	705-7126-00
A2R10	RESISTOR, FIXED, COMPOSITION: 1500 ohms ±10%; 1/2 w	745-1359-00
A2R11	RESISTOR, FIXED, FILM: 750 ohms ±1%; 1/4 w	705-7090-00
A2R12	RESISTOR, FIXED, COMPOSITION: same as A2R5	745-1384-00
A2R13	RESISTOR, FIXED, COMPOSITION: 18, 000 ohms ±10%; 1/2 w	745-1405-00
A2R14	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%; 1/2 w	745-1324-00
A2R15	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
A2R16	RESISTOR, FIXED, COMPOSITION: same as A2R13	745-1405-00
A2R17	RESISTOR, FIXED, COMPOSITION: same as A2R14	745-1324-00
A2R18	RESISTOR, FIXED, COMPOSITION: same as A2R5	745-1384-00
A2R19	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
A2R20	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
A2R21	RESISTOR, FIXED, COMPOSITION: same as A2R7	745-1394-00
A2R22	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%; 1/2 w	745-1342-00
A2R23	RESISTOR, FIXED, COMPOSITION: same as A2R22	745-1342-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 22 ohms ±10%; 1/2 w	745-1282-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 39 ohms ±10%; 1/2 w	745-1293-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 1/2 w	745-1296-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 56 ohms ±10%; 1/2 w	745-1300-00
A2S1	NOT USED	
A2T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 455-kc frequency	278-0258-00
A2T2	TRANSFORMER, INTERMEDIATE FREQUENCY: same as A2T1	278-0258-00
A2T3	TRANSFORMER, INTERMEDIATE FREQUENCY: same as A2T1	278-0258-00
A2TB1	TERMINAL BOARD: plastic board; 4-1/16 in. by 4-3/4 in. by 1/16 in.	542-4458-004
	I-F Mixers, Module Subassembly A3A3	543-1788-003
A3C1	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 33, 000 uuf ±20%	931-5893-00
A3C2	NOT USED	
A3C3	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-5893-00
A3C4	NOT USED	
A3C5	NOT USED	

*Chosen per operational requirements.

ITEM	DESCRIPTION	COLLINS PART NUMBER
A3C6	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-5893-00
A3C7	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-5893-00
A3C8	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc, 430 uuf p/m 2%	912-1877-00
A3C9	NOT USED	
A3C10	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 100 uuf ±2%	912-1832-00
A3C11	CAPACITOR, FIXED: 200 uuf ±2%	912-1853-00
A3E1	SHIELD, ELECTRON TUBE: accommodate tube style T-3	141-0348-00
A3E2	SHIELD, ELECTRON TUBE: same as A3E1	141-0348-00
A3FL1	FILTER, BAND PASS: 970- to 1130-kc frequency range	542-3153-004
A3FL2	FILTER, BAND PASS: 455-kc center frequency; 0.5 kc at 6-db bandwidth; 10 ohms impedance	526-9310-00
A3P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o I-F Mixer, built in (mates w/ J5)	526-9310-00
A3R1	RESISTOR, FIXED, COMPOSITION: 220,000 ohms ±10%; 1/2 w	745-1450-00
A3R2	RESISTOR, FIXED, COMPOSITION: 82,000 ohms ±10%; 1/2 w	745-1433-00
A3R3	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%; 1/2 w	745-1342-00
A3R4	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1/2 w	745-1419-00
A3R5	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
A3R6	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%; 1/2 w	745-1391-00
A3R7	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1/2 w	745-1422-00
A3R8	RESISTOR, FIXED, COMPOSITION: same as A3R4	745-1342-00
A3R9	RESISTOR, FIXED, COMPOSITION: same as A3R5	745-1394-00
A3R10	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1359-00
A3T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 2.4 mc frequency	278-0254-00
A3TB1	PRINTED CIRCUIT: plastic board; incl 14 terminals, 55 tubelets and 3 tube clips	543-1783-003
A3V1	ELECTRON TUBE: subminiature pentode; type 5635	255-0324-00
A3V2	ELECTRON TUBE: same as A3V1	
	I-F Mixers, Module Subassembly A3A3 (Model C)	547-3766-004
A3C1	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 22,000 uuf ±20%	931-2097-00
A3C2	NOT USED	
A3C3	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-2097-00
A3C4	NOT USED	
A3C5	NOT USED	
A3C6	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-2097-00
A3C7	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A3C1	931-2097-00
A3C8	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc, 430 uuf p/m 2%	912-1877-00
A3C9	NOT USED	
A3C10	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 100 uuf ±2%	912-1832-00
A3C11	CAPACITOR, FIXED: 200 uuf ±2%	912-1853-00
A3E1	SHIELD, ELECTRON TUBE: accommodate tube style T-3	141-0348-00
A3E2	SHIELD, ELECTRON TUBE: same as A3E1	141-0348-00
A3FL1	FILTER, BAND PASS: 970- to 1130-kc frequency range	542-3153-004
A3FL2	FILTER, BAND PASS: 455-kc center frequency; 60 kc at 6 db bandwidth	241-0331-00
A3P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o I-F Mixer, built in (mates w/ J5)	526-9310-00
A3R1	RESISTOR, FIXED, COMPOSITION: 220,000 ohms ±10%; 1/2 w	745-1450-00
A3R2	RESISTOR, FIXED, COMPOSITION: 82,000 ohms ±10%; 1/2 w	745-1433-00
A3R3	RESISTOR, FIXED, COMPOSITION: 470 ohms ±10%; 1/2 w	745-1338-00
A3R4	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1/2 w	745-1419-00
A3R5	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
A3R6	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%; 1/2 w	745-1391-00
A3R7	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1/2 w	745-1422-00
A3R8	RESISTOR, FIXED, COMPOSITION: same as A3R4	745-1338-00
A3R9	RESISTOR, FIXED, COMPOSITION: same as A3R5	745-1394-00
A3R10	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1359-00
A3R11	RESISTOR, FIXED COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00
A3T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 2.4 mc frequency	278-0254-00
A3TB1	PRINTED CIRCUIT: plastic board; incl 14 terminals, 55 tubelets and 3 tube clips	543-1783-003
A3V1	ELECTRON TUBE: subminiature pentode; type 5635	255-0324-00
A3V2	ELECTRON TUBE: same as A3V1	
	Interpolation Oscillator Module Subassembly A3A5	542-5720-003
**A5A1	FREQUENCY GENERATOR 786E-1, SMO, INTERPOLATION OSCILLATOR: 6.3 v ac, 130 v dc, operating voltage; 549 to 645 kc operating frequency	542-5720-003
	4-Kc Spectrum Generator, Module Subassembly A3A6	544-2640-00
A6C1	CAPACITOR, FIXED, PAPER DIELECTRIC: 300 v dc working; 4700 uuf ±20%	931-5645-00
A6C2	NOT USED	
A6C3	CAPACITOR, FIXED, MICA: 330 uuf ±5%; 500 v dc	912-1869-00
A6C4	CAPACITOR, FIXED, ELECTROLYTIC: 2.2 uf ±20%, 35 v dc	184-7397-00
A6C5	CAPACITOR, FIXED, MICA DIELECTRIC: same as A6C3	912-1869-00
A6C6	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 430 uuf ±2%	912-1877-00
A6C7	CAPACITOR, FIXED, ELECTROLYTIC: 35 v dc working; 220,000 uuf ±20%	184-7407-00
A6C8	CAPACITOR, FIXED, MICA DIELECTRIC: same AS A6C3	912-1869-00
A6C9	CAPACITOR, FIXED, MICA DIELECTRIC: same as A6C3	912-1869-00
A6C10	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 510 uuf ±2%	912-1883-00
A6C11	CAPACITOR, FIXED, ELECTROLYTIC: 50 v dc working; 18 uf +75%-15%	184-7228-00
A6C12	NOT USED	
A6C13	CAPACITOR, FIXED, ELECTROLYTIC: same as A6C7	184-7407-00
A6C14	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 68,000 uuf ±20%	931-5643-00
A6CR1 thru A6CR3	SEMICONDUCTOR DEVICE, DIODE: germanium; type 1N198	353-0160-00
A6E1	SHIELD, ELECTRON TUBE: style T-3	141-0348-00
A6FL1	FILTER, BAND PASS: 1.0- to 1.1-mc freq. range	543-3152-004
A6P1	CONNECTOR, PLUG, RECEPTACLE: printed circuit plug feedthru, p/o 4-Kc Spec. Gen., built in	
A6Q1	TRANSISTOR: silicon; Texas Instruments Co. type no. J-213	352-0087-00
A6Q2	TRANSISTOR: same as A6Q1	352-0087-00
A6Q3	TRANSISTOR: same as A6Q1	352-0087-00
A6R1	NOT USED	
A6R2	NOT USED	
A6R3	RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±10%' 1/2 w	745-1436-00
A6R4	RESISTOR, FIXED, COMPOSITION: 56,000 ohms ±10%' 1/2 w	745-1426-00
A6R5	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%; 1/2 w	745-1398-00
A6R6	DELETED	
A6R7	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
A6R8	RESISTOR, FIXED, COMPOSITION: 120,000 ohms ±10%; 1/2 w	745-1440-00
A6R9	NOT USED	
A6R10	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
A6R11	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 1/2 w	745-1366-00
A6R12	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%; 1/2 w	745-1408-00
A6R13	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%; 1/2 w	745-1345-00
A6R14	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00

**This is a sealed unit and it is recommended that it be sent back to Collins Radio Company for repair.

ITEM	DESCRIPTION	COLLINS PART NUMBER
A6R15	RESISTOR, FIXED, COMPOSITION: same as A6R10	745-1394-00
A6R16	RESISTOR, FIXED, COMPOSITION: same as A6R10	745-1394-00
A6R17	RESISTOR, FIXED, COMPOSITION: same as A6R12	745-1408-00
A6R18	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%; 1/2 w	745-1342-00
A6R19	NOT USED	
A6R20	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
A6T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 1050 kc	278-0261-00
A6TB1	PRINTED CIRCUIT BOARD: plastic glass epoxy 1/16 in. thk, 3.550 in. by 2.959 in.	544-2638-004
A6V1	ELECTRON TUBE: type 5636	255-0324-00
	Reference I-F Amplifier, Module Subassembly A3A7	544-2634-002
A7C1	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 82 uuf ±2%	912-1826-00
A7C2	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 180 uuf ±2%	912-1850-00
A7C3	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 510 uuf ±2%	912-1883-00
A7C4	NOT USED	
A7C5	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 200 uuf ±2%	912-1853-00
A7C6	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working; 33,000 uuf ±20%	931-5893-00
A7C7	CAPACITOR, FIXED, ELECTROLYTIC: 20 v dc working; 10 uf ±20%	184-7375-00
A7C8	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A7C6	931-5893-00
A7C9	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A7C6	931-5893-00
A7C10	CAPACITOR, FIXED, MICA DIELECTRIC: same as A7C5	912-1853-00
A7C11	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A7C6	931-5893-00
A7C12	CAPACITOR, FIXED, ELECTROLYTIC: same as A7C7	184-7375-00
A7C13	CAPACITOR, FIXED, MICA DIELECTRIC: same as A7C6	931-5893-00
A7C14	CAPACITOR, FIXED, MICA DIELECTRIC: same as A7C5	912-1853-00
A7C15	CAPACITOR, FIXED, ELECTROLYTIC: same as A7C7	184-7375-00
A7C16	CAPACITOR, FIXED, PAPER DIELECTRIC: same as A7C6	931-5893-00
A7CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type HD6006	353-0204-00
A7CR2	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft Co. type 1N270	353-2016-00
A7FL1	FILTER, BAND PASS: 455-kc frequency; 0.800 kc at 6-db bandwidth; 17,000 ohms input and output impedance	526-9309-00
A7J1	JACK, TIP: std phone tip contact element accommodated; teflon insulation	360-0129-00
A7J2	JACK, TIP: same as A7J1	360-0129-00
A7L1	COIL, RADIO FREQUENCY: single layer wound; #36 AWG; 455 kc	278-0255-00
A7L2	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc; #36 AWG; tapped	278-0259-00
A7P1	CONNECTOR, PLUG, electrical; printed circuit plug feedthru, p/o Ref. I.F., built in (mates w/J9)	
A7Q1	TRANSISTOR: silicon; Texas Instruments Co. part no. J-213	352-0087-00
A7Q2	TRANSISTOR: same as A7Q1	352-0087-00
A7Q3	TRANSISTOR: same as A7Q1	352-0087-00
A7R1	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%; 1/2 w	745-1324-00
A7R2	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
A7R3	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
A7R4	RESISTOR, FIXED, COMPOSITION: 1200 ohms ±10%; 1/4 w	745-0356-00
A7R5	RESISTOR, FIXED, FILM: 7500 ohms ±1%; 1/4 w	705-7138-00
A7R6	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%; 1/4 w	745-0363-00
A7R7	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/4 w	745-0394-00
A7R8	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1384-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A7R9	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
A7R10	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±5%; 1/2 w	745-1383-00
A7R11	RESISTOR, FIXED, FILM: 287 ohms ±1%; 1/4 w	705-7070-00
A7R12	RESISTOR, FIXED, COMPOSITION: 270,000 ohms ±10%; 1/2 w	745-1454-00
R13	RESISTOR, FIXED, COMPOSITION: 33,000 ohms p/m 10%; 1/2 w	745-1415-00
R14	RESISTOR, FIXED, COMPOSITION: 15,000 ohms p/m 10%; 1/2 w	745-1401-00
R15	RESISTOR, FIXED, COMPOSITION: 6800 ohms p/m 10%; 1/2 w	745-1387-00
A7T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc	278-0258-00
A7T2	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc	278-0270-00
A7TB1	JACK ASSEMBLY, TIP: c/o 2 std phone tip contact element accommodated tip jacks	543-1778-003
	Master Oscillator, Module Subassembly A3A1	
*A3A1	FREQUENCY GENERATOR 786E-1 SMO, MASTER OSCILLATOR, 70H-13A (MODELS B AND C): 2.0 to 4.0 mc frequency range; 6.3 v ac, 115 v ac, 60 cps, +27.5 v dc, -130 v dc operating voltage; 1-13/32 in. by 3-3/16 in. by 5-1/4 in. overall	522-1768-004
	STABILIZED MASTER OSCILLATOR, MODULE A3 (MODEL B AND MODEL C)	528-0021-005
C1	NOT USED	
C2	CAPACITOR, FIXED, PAPER: 15,000 uuf ±20%; 100 vdcw	931-5641-00
C3	CAPACITOR, VARIABLE, CERAMIC: 8.0 to 75.0 uuf 350 vdcw (p/o Z1)	917-1141-00
C4	CAPACITOR, FIXED, MICA: 82 uuf ±2%; 500 vdcw (p/o Z1)	912-1826-00
C5	CAPACITOR, FIXED, CERAMIC: 10,000 uuf +100%-20%; 500 vdcw	913-3159-00
C6	CAPACITOR, FIXED, MICA: 22 uuf ±5%; 500 vdcw	912-1786-00
C7	CAPACITOR, VARIABLE, CERAMIC: 5.0 to 37.5 uuf; 350 vdcw (p/o Z2)	917-1139-00
C8	CAPACITOR, FIXED, MICA: 68 uuf ±2%; 500 vdcw (p/o Z2)	912-1820-00
C9	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C10	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C11	CAPACITOR, FIXED, MICA: 15 uuf ±5%; 500 vdcw (p/o Z3)	912-1760-00
C12	CAPACITOR, VARIABLE, CERAMIC: 3.0 to 18.0 uuf; 350 vdcw (p/o Z3)	917-1140-00
C13	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C14	CAPACITOR, FIXED, MICA: 10 uuf ±5%; 500 vdcw (p/o Z3)	912-1776-00
C15	CAPACITOR, FIXED, MICA: 29 uuf ±5%; 500 vdcw	912-1803-00
C16	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C17	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C18	CAPACITOR, FIXED, CERAMIC: same as C5	913-3159-00
C19	CAPACITOR, FIXED, PAPER: 220,000 uuf ±20%; 100 vdcw	241-0086-00
C20	CAPACITOR, FIXED, MICA: 510 uuf ±2%; 300 vdcw	912-1883-00
C21	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 200 vdcw	931-1644-00
C22	CAPACITOR, FIXED, MICA: 2000 uuf ±10%; 500 vdcw	912-0304-00
C23	CAPACITOR, FIXED, PAPER: same as C21	931-1644-00
C24	CAPACITOR, FIXED, MICA: 470 uuf ±2%; 300 vdcw	912-1880-00
C25	CAPACITOR, FIXED, MICA: same as C24	912-1880-00
C26	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 100 vdcw	931-4602-00
C27	CAPACITOR, FIXED, MICA: same as C6	912-1786-00
C28	CAPACITOR, FIXED, PAPER: same as C21	931-1644-00
C29	CAPACITOR, FIXED, CERAMIC: 10 uuf ±1 uuf; 500 vdcw (p/o Z4)	913-0046-00
C30	CAPACITOR, VARIABLE, CERAMIC: 3.0 to 18.0 uuf; 350 vdcw (p/o Z4)	917-1120-00
C31	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 200 vdcw	931-4605-00
C32	CAPACITOR, FIXED, CERAMIC: 2.0 uuf ±1/4 uuf; 500 vdcw	929-0016-00
C33	CAPACITOR, FIXED, MICA: same as C6	912-1786-00

*This is a sealed unit and it is recommended that it be sent back to Collins Radio Company for repair.

ITEM	DESCRIPTION	COLLINS PART NUMBER
C34	CAPACITOR, FIXED, CERAMIC: same as C32	929-0016-00
C35	CAPACITOR, FIXED, MICA: same as C29 (p/o Z5)	913-0046-00
C36	CAPACITOR, VARIABLE, CERAMIC: same as C30 (p/o Z5)	917-1120-00
C37	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 300 vdcw	241-0087-00
C38	CAPACITOR, FIXED, MICA: same as C22	912-0304-00
C39	CAPACITOR, FIXED, PAPER: same as C2	931-5641-00
C40	CAPACITOR, FIXED, CERAMIC: 4.7 uf ±20%; 35 vdcw	184-7396-00
C41	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 100 vdcw	241-0088-00
C42	CAPACITOR, FIXED, PAPER: same as C41	241-0088-00
CR1 thru CR6	SEMICONDUCTOR DEVICE, DIODE: germanium; type 1N251	353-2539-00
CR7	SEMICONDUCTOR DEVICE, DIODE: germanium; type 1N198	353-0160-00
E1	NUT, PLAIN, CLINCH: p/o TB1, built in	
E2	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E3	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E4	NUT, PLAIN, CLINCH: same as E1; p/o TB1, built in	
E5	TERMINAL, STUD: tube pin type brass conductor, teflon insulation; 0.172 in. dia by 0.350 in. lg overall	306-0324-00
E6	TERMINAL, STUD: same as E5	306-0324-00
E7 thru E14	NOT USED	
E15	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6550-003
E16	SHIELD, ELECTRON TUBE: 9 pin noval; brass; incl copper insert	541-6553-003
E17	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6551-003
E18	SHIELD, ELECTRON TUBE: same as E15	541-6550-003
E19	INSERT, ELECTRON TUBE SHIELD: cadmium plated copper; w/7 tabs bent 40°	541-6532-003
E20	INSERT, ELECTRON TUBE SHIELD: same as E19	541-6532-003
E21	INSERT, ELECTRON TUBE SHIELD: same as E19	541-6532-003
E22	INSERT, ELECTRON TUBE SHIELD: cadmium plated copper; w/8 tabs bent 40°	541-6533-003
E23 thru E27	CORE, ADJUSTABLE TUNING: powdered iron; permeability 61 at 1 mc; 0.5 to 32 mc frequency range	288-2111-00
E28	TERMINAL, STUD: brass; 0.218 in. dia by 0.489 in. lg overall	306-0322-00
E29	TERMINAL, STUD: same as E5 (qty 5)	306-0324-00
E30	JACK, TIP: std phone tip contact element accommodated; plastic insulation (qty 18)	360-0077-00
FL1	FILTER, BAND PASS: 3.37 to 3.53 mc frequency range	543-1781-003
H1	ALIGNMENT TOOL, ELECTRONIC EQUIPMENT: brass bit and plastic holder; 2 working ends	543-1723-002
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 flat female contacts, 10 amp, 2500 v rms; straight (mates w/ A1P1)	372-1601-00
J2	JACK, TIP: std phone tip contact element accommodated; teflon insulation	360-0090-00
J3	JACK, TIP: std phone tip contact element accommodated; teflon insulation (p/o Z2)	360-0129-00
J4	CONNECTOR, RECEPTACLE, ELECTRICAL: 10 female contacts, 5 amp; straight (mates w/ A2P1)	372-1669-00
J5	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A3P1)	372-1669-00
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4	372-1669-00
J7	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 female contacts, 5 amps, 1500 v dc; straight (mates w/ A5P1)	372-1539-00
J8	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A6P1)	372-1669-00
J9	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J4 (mates w/ A7P1)	372-1669-00
J10	NOT USED	
J11	NOT USED	
J12	JACK, TIP: same as J3 (p/o Z3)	360-0129-00
J13	JACK, TIP: same as J3 (p/o Z1)	360-0129-00
L1	COIL, RADIO FREQUENCY: universal wound pi sections; no. 40 AWG; 2.0 mh, 100 uuf, 35 ma	240-0084-00
L2	COIL, RADIO FREQUENCY: single layer wound; 15 turns no. 26 AWG; 16 to 32 mc frequency range (p/o Z3)	543-1691-002
L3	COIL, RADIO FREQUENCY: single layer wound; no. 36 AWG; 6.5 mh	278-0257-00
L4	COIL, RADIO FREQUENCY: single layer wound; 15 turns no. 28 AWG; 19.5 to 35.5 mc frequency range (p/o Z4)	543-1692-002
L5	COIL, RADIO FREQUENCY: same as L4)p/o Z5)	543-1692-002
L6	COIL, RADIO FREQUENCY: same as L1	240-0084-00
L7	COIL, RADIO FREQUENCY: single layer wound; magnet wire; 39 uh, 0.60 ohms, 1000 ma	240-0189-00
L8	NOT USED	
MP1	GEAR ASSEMBLY: 2 gears; 1 w/ 135 teeth, 2.8125 in. pitch dia; 1 w/ 22 teeth, 0.4583 in. pitch dia; ea 20° pressure angle (incl MP33)	543-1650-002
MP2	GEAR, SPUR: 30 teeth, 20° pressure angle, 0.6250 in. pitch dia	543-1651-002
MP3	GEAR ASSEMBLY: 2 gears; 1 w/ 52 teeth, 1.0833 in. pitch dia; 1 w/ 22 teeth, 0.3437 in. pitch dia; ea 20° pressure angle; incl arm (incl MP32)	543-1811-002
MP4	NOT USED	
MP5	GEAR ASSEMBLY: 2 gears; 1 w/ 88 teeth, 1.375 in. pitch dia; 1 w/ 18 teeth, 0.375 in. pitch dia; ea 20° pressure angle (incl MP35)	543-1646-002
MP6	GEAR, SPUR: 88 teeth, 20° pressure angle, 1.8333 in. pitch dia	543-1655-002
MP7	NOT USED	
MP8	BEARING, BALL, ANNULAR: single row; radial; 0.359 in. od, 0.1875 in. id, 0.125 in. thk	309-0659-00
MP9	SPRING, HELICAL, EXTENSION: stainless steel; wire 0.033 in. dia hook ends; 4-1/2 coils; 0.472 in. overall	542-5381-002
MP10	NOT USED	
MP11	SPRING, HELICAL, EXTENSION: steel music wire; 9/64 in. id, 0.156 in. od, 5/16 in. lg	340-2090-00
MP12	CAM, CONTROL: aluminum anodized; 0.375 in. id, 1.500 in. od, 0.381 in. thk overall	543-1806-002
MP13	PULLEY, FLAT: c/o bearing, pin and liner; 3/4 in. od, 7/64 in. thk approx	543-1688-002
MP14	BEARING, BALL, ANNULAR: single row; radial; 0.625 in. od, 0.25 in. id, 0.196 in. thk	309-1360-00
MP15	SHAFT, DRIVE, FLEXIBLE: 5-5/16 in. lg by 5/8 in. dia overall; incl roller and pin	543-1642-00
MP16	BEARING, BALL, ANNULAR: single row; radial; 0.296 in. od, 0.125 in. id, 0.1094 in. thk	309-0656-00
MP17	BEARING, BALL, ANNULAR: same as MP16	309-0656-00
MP18	BEARING, BALL, ANNULAR: same as MP16	309-0656-00
MP19	BEARING, BALL, ANNULAR: same as MP8	309-0659-00
MP20	NOT USED	
MP21	NOT USED	
MP22	GEAR, GUIDE: c/o plate, spring, pin guide and hardware	543-1737-002
MP23	BEARING, BALL, ANNULAR: same as MP14	309-1360-00
MP24	PULLEY, FLAT: same as MP13	543-1688-002
MP25	SPRING, HELICAL EXTENSION: same as MP9	542-5381-002
MP26	NOT USED	
MP27	BEARING, BALL, ANNULAR: single row; radial; 0.1875 in. id, 0.500 in. od, 0.1969 in. thk	309-0300-00
MP28	BEARING, BALL, ANNULAR: same as MP27	309-0300-00
MP29	HUB: anodized aluminum; grooved; 0.443 in. lg by 3/8 in. dia overall	543-1633-002
MP30	HUB: same as MP29	543-1633-002
MP31	GEAR, SPUR: 22 teeth, 20° pressure angle, 0.4583 in. pitch dia	543-1647-002
MP32	GEAR ASSEMBLY: 2 gears; 1 w/ 52 teeth, 1.0833 in. pitch dia; 1 w/ 22 teeth, 0.3437 in. pitch dia; ea 20° pressure angle (p/o MP3)	543-1648-002
MP33	GEAR, SPUR: 22 teeth, 20° pressure angle, 0.3437 in. pitch dia (p/o MP1)	543-1653-002
MP34	NOT USED	
MP35	GEAR, SPUR: 18 teeth, 20° pressure angle, 0.375 in. pitch dia (p/o MP5)	543-1644-002
MP36	SPRING, HELICAL, COMPRESSION: stainless steel; rh wire 0.018 in. dia; 13 coils; 13/16 in. lg	543-1736-002
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 rd male contacts, 1700 v dc, 5 amps straight	371-0029-00
R1	NOT USED	
R2	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1 w	745-3387-00
R3	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 1/2 w	745-1310-00
R4	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00
R5	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1 w	745-3422-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R6	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
R7	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%; 1/2 w	745-1422-00
R8	RESISTOR, FIXED, COMPOSITION: 330 ohms ±10%; 1/2 w	745-1331-00
R9	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%; 1 w	745-3391-00
R10	RESISTOR, FIXED, COMPOSITION: same as R6	745-1394-00
R11	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
R12	NOT USED	
R13	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%; 1 w	745-3408-00
R14	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1 w	745-3419-00
R15	RESISTOR, FIXED, COMPOSITION; 2200 ohms ±10%; 1/2 w	745-1366-00
R16	RESISTOR, FIXED, COMPOSITION: same as R8	745-1331-00
R17	RESISTOR, FIXED, COMPOSITION: same as R8	745-1331-00
R18	RESISTOR, FIXED, COMPOSITION: same as R15	745-1366-00
R19	RESISTOR, FIXED, COMPOSITION: same as R7	745-1422-00
R20	RESISTOR, FIXED, COMPOSITION: 15 ohms ±10%; 1/2 w	745-1275-00
R21	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
R22	RESISTOR, FIXED, COMPOSITION: same as R4	745-1401-00
R23	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%; 1 w	745-3415-00
R24 thru R27	NOT USED	
R28	RESISTOR, FIXED, COMPOSITION: same as R6	745-1394-00
R29	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-1401-00
R30	NOT USED	
R31	RESISTOR, FIXED, COMPOSITION: same as R6	745-1394-00
R32	RESISTOR, FIXED, COMPOSITION: 82,000 ohms ±10%; 1/2 w	745-1433-00
T1	COIL, RADIO FREQUENCY: universal wound; 66 turns Litz wire; 2 to 4 mc frequency range (p/o Z1)	543-1753-002
T2	TRANSFORMER, RADIO FREQUENCY: two windings; 2 turns no. 30 AWG, 44 turns no. 32 AWG; 4 to 8 mc frequency range (p/o Z2)	543-1690-002
TB1	TERMINAL BOARD: plastic board; incl 4 terminals (incl E1, E2, E3, E4, built in)	543-1683-002
TB2	TERMINAL BOARD: plastic board; incl 3 terminals and 3 eyelets	543-1724-002
V1	ELECTRON TUBE: glass envelope; pentode type 5654	253-0001-00
V2	ELECTRON TUBE: glass envelope; pentagrid converter type 5750	253-0007-00
V3	ELECTRON TUBE: same as V1	253-0001-00
V4	ELECTRON TUBE: double triode; type 5670	253-0002-00
XV1	SOCKET, ELECTRON TUBE: 7 pin miniature	220-1291-00
XV2	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00
XV3	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00
XV4	SOCKET, ELECTRON TUBE: 9 pin miniature	220-1293-00
Z1	TUNING UNIT, RADIO FREQUENCY: 2 to 4 mc frequency range (incl T1, C3, C4, J13)	543-1771-003
Z2	TUNING UNIT, RADIO FREQUENCY: 4 to 8 mc frequency range (incl T2, C7, C8, J3)	544-7235-005
Z3	TUNING UNIT, RADIO FREQUENCY: 16 to 32 mc frequency range (incl L2, C11, C12, C14, J12)	544-7236-005
Z4	TUNING UNIT, RADIO FREQUENCY: 19.5 to 35.5 mc frequency range (incl L4, C29, C30)	543-1775-003
Z5	TUNING UNIT, RADIO FREQUENCY: 19.5 to 35.5 mc frequency range (incl L5, C35, C36)	543-1776-003
	Signal I-F Amplifier, Module Subassembly A3A2 (Model B)	545-5866-005
A2C1	CAPACITOR, FIXED, PAPER: 10,000 uuf ±20%; 100 vdcw	931-5649-00
A2C2	CAPACITOR, FIXED, PAPER: same as A2C1	931-5649-00
A2C3	NOT USED	
A2C4	NOT USED	
A2C5	CAPACITOR, FIXED, MICA: 2,000 uuf ±10%; 500 vdcw	912-1750-00
A2C6	CAPACITOR, FIXED, MICA: same as A2C5	912-1750-00
A2C7	CAPACITOR, FIXED, CERAMIC: 0.02 uf +60% -40%; 250 vdcw	913-2097-00
A2C8	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf ±20%; 20 vdcw	184-7375-00
A2C9	CAPACITOR, FIXED, MICA: 160 uuf ±5%; 500 vdcw	912-1848-00
A2C10	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C8	184-7375-00
A2C11	NOT USED	
A2C12	CAPACITOR, FIXED, ELECTROLYTIC: 180 uf ±20%; 6 vdcw	184-7646-00
A2C13	CAPACITOR, FIXED, MICA: 200 uuf ±2%; 500 vdcw	912-1853-00
A2C14	CAPACITOR, FIXED, PAPER: 33,000 uuf ±20%; 200 vdcw	931-5893-00
A2C15	CAPACITOR, FIXED, PAPER: same as A2C14	931-5893-00
A2C16	CAPACITOR, FIXED, MICA: same as A2C13	912-1853-00
A2C17	CAPACITOR, FIXED, PAPER: same as A2C14	931-5893-00
A2C18	CAPACITOR, FIXED, PAPER: 100,000 uuf ±20%; 200 vdcw	931-5892-00
A2C19	CAPACITOR, FIXED, PAPER: same as A2C14	931-5893-00
A2C20	CAPACITOR, FIXED, MICA: same as A2C13	921-1853-00
A2C21	NOT USED	
A2C22	CAPACITOR, FIXED, PAPER: same as A2C14	931-5893-00
A2C23	NOT USED	
A2C24	NOT USED	
A2C25	NOT USED	
*A2C26 and *A2C27	CAPACITOR, FIXED, CERAMIC: 100 uuf ±5%; 500 vdcw	913-2940-00
*A2C26 and *A2C27	CAPACITOR, FIXED, CERAMIC: 100 uuf ±5%; 500 vdcw	913-2941-00
*A2C26 and *A2C27	CAPACITOR, FIXED, CERAMIC: 100 uuf ±5%; 500 vdcw	913-2916-00
*A2C26 and *A2C27	CAPACITOR, FIXED, CERAMIC: 100 uuf ±5%; 500 vdcw	913-2942-00
*A2C26 and *A2C27	CAPACITOR, FIXED, CERAMIC: 100 uuf ±20%; 500 vdcw	913-2910-00
A2C28	CAPACITOR, FIXED, ELECTROLYTIC: .68 uf ±20%; 35 vdcw	912-5948-00
A2C29	CAPACITOR, FIXED, CERAMIC: 1000 uuf +100% -20%; 500 vdcw	913-1186-00
A2C30	CAPACITOR, FIXED, CERAMIC: same as A2C29	913-1186-00
A2C31	CAPACITOR, FIXED, MICA: 510 uuf ±5%; 300 vdcw	912-1884-00
A2C32	CAPACITOR, FIXED, MICA: 33 uuf ±5%; 500 vdcw	912-1797-00
A2C33	CAPACITOR, FIXED, MICA: same as A2C32	912-1797-00
A2C34	CAPACITOR, FIXED, MICA: 240 uuf ±5%; 500 vdcw	912-1860-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2943-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2944-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2945-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2946-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2947-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2948-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2949-00
*A2C35 and *A2C36	CAPACITOR, FIXED, CERAMIC: 50 uuf ±5%; 500 vdcw	913-2950-00
A2C37	CAPACITOR, FIXED, MICA: 2000 uuf ±5%; 300 vdcw	912-1750-00
A2C38	CAPACITOR, FIXED, ELECTROLYTIC: (tantalum) 4.7 uf ±20%; 35 vdcw	184-7396-00
A2CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; Transitron part no. 1N270	353-2018-00
A2CR2	SEMICONDUCTOR DEVICE, DIODE: same as A2CR1	353-2018-00
A2CR3	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft part no. HD6006	353-0204-00
A2CR4	SEMICONDUCTOR DEVICE, DIODE: same as A2CR3	353-0204-00
A2CR5	SEMICONDUCTOR DEVICE, DIODE: same as A2CR1	353-2018-00

*Chosen per operational requirement.

ITEM	DESCRIPTION	COLLINS PART NUMBER
A2CR6	SEMICONDUCTOR DEVICE, DIODE: same as A2CR1	353-2018-00
A2J1	JACK, TIP: std phone tip accommodated; teflon insulation	360-0129-00
A2J2	JACK, TIP: same as A2J1	360-0129-00
A2L1	COIL, RADIO FREQUENCY: single layer wound; #36 AWG; 455 KC	278-0298-00
A2L2	COIL, RADIO FREQUENCY: same as A2L1	278-0298-00
A2L3	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc; #36 AWG; tapped	278-0259-00
A2L4	COIL, RADIO FREQUENCY: single layer wound; #36 AWG; 455 kc	278-0255-00
A2P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o Signal I.F., built in (mates w/ J4)	
A2Q1	NOT USED	
A2Q2	NOT USED	
A2Q3 thru A2Q6	TRANSISTOR: silicon; Texas Instruments part no. J-213	352-0087-00
A2R1	NOT USED	
A2R2	NOT USED	
A2R3	NOT USED	
A2R4	RESISTOR, FIXED, FILM: 464 ohms ±1%; 1/4 w	705-7080-00
A2R5	RESISTOR, FIXED, FILM: 10,000 ohms ±1%; 1/4 w	705-7144-00
A2R6	RESISTOR, FIXED, COMPOSITION: 180,000 ohms ±10%; 1/2 w	745-1447-00
A2R7	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%; 1/2 w	745-1394-00
A2R8	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1384-00
A2R9	RESISTOR, FIXED, FILM: 4220 ohms ±1%; 1/4 w	705-7126-00
A2R10	RESISTOR, FIXED, COMPOSITION: 820 ohms ±10%; 1/2 w	745-1349-00
A2R11	RESISTOR, FIXED, FILM: 750 ohms ±1%; 1/4 w	705-7090-00
A2R12	RESISTOR, FIXED, COMPOSITION: same as A2R8	745-1384-00
A2R13	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
A2R14	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%; 1/2 w	745-1324-00
A2R15	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
A2R16	RESISTOR, FIXED, COMPOSITION: same as A2R13	745-1405-00
A2R17	RESISTOR, FIXED, COMPOSITION: same as A2R14	745-1324-00
A2R18	RESISTOR, FIXED, COMPOSITION: same as A2R8	745-1384-00
A2R19	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
A2R20	NOT USED	
A2R21	RESISTOR, FIXED, COMPOSITION: same as A2R13	745-1405-00
A2R22	NOT USED	
A2R23	NOT USED	
*A2R24	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%; 1/2 w	745-1268-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 18 ohms ±10%; 1/2 w	745-1279-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 27 ohms ±10%; 1/2 w	745-1286-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 39 ohms ±10%; 1/2 w	745-1293-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 1/2 w	745-1296-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
*A2R24	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 1/2 w	745-1310-00
A2R25	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±5%; 1/2 w	745-1421-00
A2R26	RESISTOR, FIXED, COMPOSITION: same as A2R25	745-1421-00
A2R27	RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±10%; 1/2 w	745-1436-00
A2R28	RESISTOR, FIXED, FILM: 21,500 ohms ±1%; 1/4 w	705-7160-00
A2R29	RESISTOR, FIXED, FILM: same as A2R28	705-7160-00
A2R30	RESISTOR, FIXED, COMPOSITION: 56K ohms ±10%; 1/2 w	745-1426-00
A2R31	RESISTOR, FIXED, COMPOSITION: same as R10	745-1349-00
A2S1	SWITCH, THERMOSTATIC: spst; contacts open on temp increase; 75°C temp setting; bimetal element; 115 v ac at 2.5 amp; 28 v dc at 2.0 amp	292-0132-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A2T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 425 to 485 kc tuning range; interstage; shielded; 1/2 in. h by 17/32 in. od; powdered iron coil form	278-0296-00
A2T2	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc frequency	278-0258-00
A2T3	TRANSFORMER, INTERMEDIATE FREQUENCY: same as A2T2	278-0258-00
A2T4	TRANSFORMER, INTERMEDIATE FREQUENCY: 450 to 460 kc tuning range; interstage; shielded; 1/2 in. h by 17/32 in. od; powdered iron coil form	278-0297-00
A2TB1	TERMINAL BOARD: plastic glass epoxy; 1/16 in. thk by 4.062 in. w by 6 in. lg overall; incl 14 terminals, 12 eyelets, 139 tubelets, 4 transistor clips, 2 test points and one test point bracket	545-5865-005
	AFC Meter Amplifier Module Subassembly A3A8 (Model B)	546-7884-004
A8CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Transitron part no. 1N816	353-2564-00
A8CR2	SEMICONDUCTOR DEVICE, DIODE: same as A8CR1	353-2564-00
A8R1	RESISTOR, VARIABLE: wire wound; 20,000 ohms ±5%; 1/2 w; 1 w when mtd on 4 in. sq steel panel	381-1289-00
A8R2	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%; 1/2 w	745-1370-00
A8R3	RESISTOR, FIXED, COMPOSITION: same as A8R2	745-1370-00
A8R4	NOT USED	
A8R5	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%; 1 w	745-3342-00
A8R6	RESISTOR, FIXED, COMPOSITION: 330 ohms ±10%; 1 w	745-3331-00
A8R7	RESISTOR, FIXED, FILM: 4,220 ohms ±1%; 1/4 w	705-7126-00
A8V1	ELECTRON TUBE: Raytheon part no. 6021	255-0238-00
	AFC Meter Amplifier Module Subassembly A3A8 (Model C)	548-8058-004
A8CR1	SEMICONDUCTOR DEVIDE, DIODE: silicon; Transitron part no. 1N816	353-2564-00
A8CR2	SEMICONDUCTOR DEVICE, DIODE: same as A8CR1	353-2564-00
A8R1	RESISTOR, VARIABLE: wire wound; 20,000 ohms ±5%; 1/2 w; 1 w when mtd on 4 in. sq steel panel	381-1289-00
A8R2	RESISTOR, FIXED, COMPOSITION: 2700 ohms ±10%; 1/2 w	745-1370-00
A8R3	RESISTOR, FIXED, COMPOSITION: same as A8R2	745-1370-00
A8R4	NOT USED	
A8R5	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%; 1 w	745-3342-00
A8R6	RESISTOR, FIXED, COMPOSITION: 330 ohms ±10%; 1 w	745-3331-00
A8R7	RESISTOR, FIXED, FILM: 6190 ohms ±1%; 1/4 w	705-7134-00
A8V1	ELECTRON TUBE: Raytheon part no. 6021	255-0238-00
	R-F TUNER, MODULE A4	542-7792-005
B1 or B1	MOTOR, DIRECT CURRENT: permanent magnet; 27.5 v dc, 0.120 amp MOTOR, DIRECT CURRENT: same as B1	230-0284-00 230-0323-00
C1	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 10,000 uuf +100 -20%	913-3159-00
C2	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 130 uuf ±2% (p/o Z1)	912-1841-00
C3	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 8.0 to 75.0 uuf (p/o Z1)	917-1122-00
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C5	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 3.0 uuf ±1/2 uuf	929-0022-00
C6	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 150 uuf ±2%; (p/o Z2)	912-1844-00
C7	CAPACITOR, VARIABLE CERAMIC DIELECTRIC: 350 v dc working; 8.0 to 75.0 uuf (p/o Z2)	917-1141-00
C8	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	929-0022-00
C9	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z3)	912-1844-00
C10	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z3)	917-1122-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C11	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 100 uuf ±10%	912-0495-00
C12	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C13	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 20 uuf ±5%	912-1784-00
C14	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z4)	912-1844-00
C15	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	929-0022-00
C16	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z4)	917-1122-00
C17	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C18	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z5)	912-1844-00
C19	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C7 (p/o Z5)	917-1141-00
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 75 uuf ±5%; w/ #9841 durez dip added (p/o Z6)	929-1954-00
C21	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	929-0022-00
C22	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 36 uuf ±5%; w/ #9841 durez dip added (p/o Z6)	929-1596-00
C23	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C24	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z6)	917-1122-00
C25	CAPACITOR, FIXED, MICA DIELECTRIC: 5 to 37.5 uuf, 350 v dc	917-1073-00
C26	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	929-0022-00
C27	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C5	929-0022-00
C28	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 56 uuf ±2% (p/o Z7)	912-1814-00
C29	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 5.0 to 37.5 uuf (p/o Z7)	917-1121-00
C30	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 56 uuf ±5% (p/o Z8)	929-1866-00
C31	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z8)	917-1121-00
C32	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 1.0 uuf ±1/4 uuf	929-0008-00
C33	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 43 uuf ±2% (p/o Z9)	912-1805-00
C34	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z9)	917-1121-00
C35	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 39 uuf ±2%; (p/o Z10)	929-1836-00
C36	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z10)	917-1121-00
C37	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C32	929-0008-00
C38	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 vdcw; 1.0 uuf ±1/4 uuf	929-0008-00
C39	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 9 0 to 18.0 uuf (p/o Z11)	917-1120-00
C40	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 30 uuf ±2%; (p/o Z12)	912-1793-00
C41	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z12)	917-1120-00
C42	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 5.0 uuf ±1/2 uuf (p/o Z13)	929-0560-00
C43	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z13)	917-1120-00
C44	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C45	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C46	CAPACITOR, FIXED, MICA DIELECTRIC: same as C25	912-1778-00
C47	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C48	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 22 uuf ±5%	912-1786-00
C49	CAPACITOR, FIXED, MICA DIELECTRIC: 180 uuf ±2%, 500 v dc (p/o Z14)	912-1850-00
C50	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 390 uuf ±2% (p/o Z14)	912-1874-00
C51	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z14)	917-1122-00
C52	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 62 uuf ±5%; (p/o Z15)	929-1940-00
C53	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z15)	912-1844-00
C54	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z15)	917-1121-00
C55	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 43 uuf ±5%; (p/o Z16)	929-1794-00
C56	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 220 uuf ±2%; (p/o Z16)	912-1856-00
C57	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z16)	917-1121-00
C58	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C42 (p/o Z17)	929-0560-00
C59	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 24 uuf ±5%; (p/o Z17)	912-1788-00
C60	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z17)	917-1120-00
C61	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C62	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C63	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C64	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 62 uuf ±2%; (p/o Z18)	912-1820-00
C65	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z18)	917-1121-00
C66	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 1.5 uuf ±1/4 uuf	929-0012-00
C67	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 1000 uuf guarantee min	913-1476-00
C68	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 82 uuf ±2%; (p/o Z19)	912-1823-00
C69	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29	917-1121-00
C70	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C66	929-0012-00
C71	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z20)	917-1121-00
C72	CAPACITOR, FIXED, MICA DIELECTRIC: same as C2 (p/o Z20)	912-1841-00
C73	CAPACITOR, FIXED, MICA DIELECTRIC: same as C2	912-1841-00
C74	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 100, 000 uuf ±20%	931-6541-00
C75	CAPACITOR, FIXED, PAPER DIELECTRIC: 400 v dc working; 100, 000 uuf ±20%	931-1651-00
C76	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C75	931-1651-00
C77	CAPAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z21)	917-1122-00
C78	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z21)	912-1844-00
C79	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 360 uuf ±2%; (p/o Z21)	912-1871-00
C80	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z22)	917-1121-00
C81	CAPACITOR, FIXED, MICA DIELECTRIC: same as C68 (p/o Z22)	912-1823-00
C82	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 470 uuf ±2% (p/o Z22)	912-1880-00
C83	CAPACITOR, FIXED, MICA DIELECTRIC: same as C79 (p/o Z22)	912-1871-00
C84	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C29 (p/o Z23)	917-1121-00
C85	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 51 uuf ±2%; (p/o Z23)	912-1811-00
C86	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 430 uuf ±2% (p/o Z23)	912-1877-00
C87	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z24)	917-1120-00
C88	CAPACITOR, FIXED, MICA DIELECTRIC: same as C25 (p/o Z24)	912-1778-00
C89	CAPACITOR, FIXED, MICA DIELECTRIC: same as C56 (p/o Z24)	912-1856-00
C90	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C91	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 8.0 to 50.0 uuf	917-1144-00
C92	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C93	CAPACITOR, FIXED, MICA DIELECTRIC: same as C13	912-1784-00
C94	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C95	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C96	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C97	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C98	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C99	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C100	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C101	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C102	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C103	NOT USED	
C104	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C105	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C106	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C107	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C108	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C109	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 1000 uuf +100 -20%	913-3161-00
C110	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C111	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C112	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C113	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C114	NOT USED	
C115	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C116	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C117	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C118	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6 (p/o Z25)	912-1844-00
C119	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 2400 uuf ±2%; (p/o Z25)	912-3341-00
C120	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C3 (p/o Z25)	917-1122-00
C121	CAPACITOR, FIXED, MICA DIELECTRIC: same as C2	912-1841-00
C122	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C123	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C124	NOT USED	
C125	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z26)	917-1120-00
C126	CAPACITOR, FIXED, CERAMIC DIELECTRIC: (p/o Z26) 500 v dc, 68 uuf; ±2%	929-1876-00
C127	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C32 (p/o Z26)	929-0010-00
C128	CAPACITOR, FIXED, MICA DIELECTRIC: same as C64 (p/o Z26)	912-1817-00
C129	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 3.0 to 12.0 uuf (p/o Z27)	917-1145-00
C130	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 20 uuf ±5%; (p/o Z27)	929-0616-00
C131	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 180 uuf ±2% (p/o Z27)	912-1850-00
C132	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C133	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C134	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C135	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C136	NOT USED	
C137	CAPACITOR, FIXED, CERAMIC DIELECTRIC: (p/o Z28); same as C126	929-1876-00
C138	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 5.0 to 25.0 uuf (p/o Z28)	917-1146-00
C139	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 4.0 uuf ±1/2 uuf	929-0026-00
C140	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 24.0 uuf ±5% w/ #9841 durez dip added (p/o Z29)	929-0502-00
C141	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z29)	917-1120-00
C142	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C143	CAPACITOR, FIXED, MICA DIELECTRIC: same as C59	912-1788-00
C144	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C139	929-0026-00
C145	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 2.0 uuf ±1/2 uuf	929-0018-00
C146	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 2.4 uuf ±5%	913-2986-00
C147	NOT USED	
C148	CAPACITOR, FIXED MICA DIELECTRIC: same as C40 (p/o Z30)	912-1793-00
C149	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C39 (p/o Z30)	917-1120-00
C150 thru C158	NOT USED	
C159 thru C169	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C170	NOT USED	
C171	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 240 uuf ±10%	912-0522-00
C172	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C173	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C174	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C175	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C67	913-1476-00
C176	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C91 (p/o Z28)	917-1144-00
C177	CAPACITOR, FIXED, MICA DIELECTRIC: same as C50	912-1868-00
C178	CAPACITOR, FIXED, MICA DIELECTRIC: 500 vdcw, 390 uuf; ±2%	912-1874-00
C179	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C1	913-3159-00
C180	CAPACITOR, FIXED, MICA DIELECTRIC: same as C2	912-1841-00
C181	CAPACITOR, FIXED, CERAMIC: same as C66	929-0012-00
C182	CAPACITOR, FIXED, CERAMIC: same as C66	929-0012-00
C183	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft Co. type no HD2123	353-0148-00
CR2	SEMICONDUCTOR DEVICE, DIODE: silicon, type no. 1N457	353-0204-00
CR3	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-0204-00
E1	SHIELD, ELECTRON TUBE: 9 pin medium; brass; incl copper insert	541-6554-003
E2	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6551-003
E3	SHIELD, ELECTRON TUBE: same as E1	541-6554-003
E4	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E5	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E6	SHIELD, ELECTRON TUBE: 9 pin noval; brass; incl copper insert	541-6555-003
E7	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E8	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E9	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6550-003
E10	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E11	TERMINAL, FEEDTHRU, INSULATED: brass conductor, teflon insulation	306-0323-00
E12 thru E15	TERMINAL, FEEDTHRU, INSULATED: same as E11	306-0323-00
E16	DELETED	
E17 thru E20	TERMINAL, FEEDTHRU, INSULATED: same as E11	306-0323-00
E21	TERMINAL, STUD: tube pin type brass conductor; teflon insulation	306-0324-00
E22	JACK, TIP: std phone tip contact element accommodated, plastic insulation	360-0077-00
E23	TERMINAL, STUD: brass conductor; 0.218 in. dia by 0.489 in. lg overall (qty 15)	306-0322-00
E24	CORE, ADJUSTABLE TUNING: powdered iron; permeability 0.5 to 32 mc frequency range (qty 30)	288-2111-00
E25	TERMINAL, STUD: same as E21	306-0324-00
E26	TERMINAL, STUD: same as E21	306-0324-00
E27	TERMINAL, FEEDTHRU, INSULATED: brass hex, melamine, 2-56 NC-2, tap 5/64 in. deep, 13/32 in. lg	306-0348-00
H1	NUT, SELF-LOCKING, HEXAGON: type 303 passivated steel; 4-40 NC-2B thd, 3/8 in. lg by 1/4 in. across hex	543-2887-002
H2	NOT USED	
H3	SCREW, EXTERNALY RELIEVED BODY: passivated steel; 8-32 NC-2A thd. 4 in. lg	543-2922-002

ITEM	DESCRIPTION	COLLINS PART NUMBER
H4	SHIM: chromate dipped aluminum; 3/4 in. by 5.16 in. by 0.032 in. (qty 30)	543-2925-002
J1	JACK, TIP: std phone tip contact element accommodated; teflon insulation (p/o Z2)	360-0129-00
J2	JACK, TIP: same as J1	360-0129-00
J3	JACK, TIP: same as J1	360-0129-00
J4	JACK, TIP: same as J1 (p/o Z5)	360-0129-00
J5 thru J16	JACK, TIP: same as J1	360-0129-00
K1	RELAY, ARMATURE: 2C; 30 v dc at 2 amps resistive; 1 inductive winding, 27.5 v dc, 450 ohms, .06 amp approx	974-0449-00
K2	RELAY, ARMATURE: 2A, 1B; 28 v dc at 250 ma; 1 inductive winding, 26.5 v dc, 720 ohms, .03 amp approx	974-0595-00
L1	COIL, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (p/o Z1)	543-2950-002
L2	COIL, RADIO FREQUENCY: same as L1 (p/o Z2)	543-2950-002
L3	COIL, RADIO FREQUENCY: same as L1 (p/o Z3)	543-2950-002
L4	COIL, RADIO FREQUENCY: same as L1 (p/o Z4)	543-2950-002
L5	COIL, RADIO FREQUENCY: same as L1 (p/o Z5)	543-2950-002
L6	COIL, RADIO FREQUENCY: same as L1 (p/o Z6)	543-2950-002
L7	COIL, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (p/o Z7)	543-2945-002
L8	COIL, RADIO FREQUENCY: same as L7 (p/o Z8)	543-2945-002
L9	COIL, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (p/o Z9)	543-2946-002
L10	COIL, RADIO FREQUENCY: same as L9 (p/o Z10)	543-2946-002
L11	COIL, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (p/o Z11)	543-2947-002
L12	COIL, RADIO FREQUENCY: same as L11 (p/o Z12)	543-2947-002
L13	COIL, RADIO FREQUENCY: same as L11 (p/o Z13)	543-2947-002
L14	COIL, RADIO FREQUENCY: same as L7 (p/o Z18)	543-2945-002
L15	COIL, RADIO FREQUENCY: same as L7 (p/o Z19)	543-2945-002
L16	COIL, RADIO FREQUENCY: same as L7 (p/o Z20)	543-2945-002
L17	COIL, RADIO FREQUENCY: same as L1 (p/o Z21)	543-2950-002
L18	COIL, RADIO FREQUENCY: same as L7 (p/o Z22)	543-2945-002
L19	COIL, RADIO FREQUENCY: same as L9 (p/o Z23)	543-2946-002
L20	COIL, RADIO FREQUENCY: same as L11 (p/o Z24)	543-2947-002
L21 thru L25	COIL, RADIO FREQUENCY: universal wound, 3 pi, 216 total turns; 220 uh, 100 ma	240-0198-00
L26	COIL, RADIO FREQUENCY: 14 to 28 mc frequency range (p/o Z26)	543-2949-002
L27	COIL, RADIO FREQUENCY: same as L26 (p/o Z27)	543-2949-002
L28	NOT USED	
L29	COIL, RADIO FREQUENCY: same as L26 (p/o Z29)	543-2949-002
L30	NOT USED	
L31	NOT USED	
L32	COIL, RADIO FREQUENCY: universal wound, 3 pi; 38 AWG; 1 mh, 60 ma	240-0313-00
L33	COIL, RADIO FREQUENCY: same as L32	240-0313-00
L34	COIL, RADIO FREQUENCY: universal wound, 3 pi, 72 turns each section; #36 AWG, 220 uh inductance, 100 ma current	240-0198-00
MP1 thru MP4	PULLEY, FLAT: c/o needle bearing and flat pulley; 0.593 in. od by 0.453 in. thk approx	543-2880-002
MP5	PULLEY, FLAT: c/o needle bearing and flat pulley; 1.122 in. dia by 0.453 in. thk approx	543-2882-002
MP6	PULLEY, FLAT: same as MP5	543-2882-002
MP7	SPRING, HELICAL EXTENSION: type 302 stainless steel; wire 0.050 in. dia; 5/16 in. od; 2-1/2 in. max spring extension	543-2888-002
MP8	SPRING, HELICAL EXTENSION: same as MP7	543-2888-002
MP9	SHAFT, SWITCH: glass bonded mica; 0.187 in. dia by 8.764 in. lg overall	543-2910-002
MP10	SHAFT, DRIVE, FLEXIBLE: steel passivated 12.311 in. lg by 1.095 in. dia approx; grooved and chamfered	543-2964-003
MP11	COUPLER, SHAFT: plastic; incl roll pin; 3/8 in. dia by 7/16 in. lg	548-1284-00
MP12	BEARING, BALL, ANNULAR: single row, radial; 0.422 in. od, 0.2500 in. id, 0.125 in. lg	309-0662-00
MP13	BEARING, BALL, ANNULAR: same as MP12	309-0662-00
MP14	SPRING, LOCKING: type 302 stainless steel wire, 0.030 in. dia; 0.030 in. by 0.224 in. by 0.310 in. (qty 30)	502-6005-002
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts, 1000 v ac and dc, 5 amps; straight	371-0020-00
P2	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 rd male contacts, 1700 v dc, 5 amps; straight	371-0283-00
R1	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
R2	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R3	RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±10%; 1/2 w	745-1464-00
R4	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%; 1/2 w	745-1314-00
R5	RESISTOR, FIXED, COMPOSITION: 2,200 ohms ±10%; 2 w	745-5666-00
R6	RESISTOR, FIXED, COMPOSITION: 1,000 ohms ±10%; 1/2 w	745-3352-00
R7	RESISTOR, FIXED, COMPOSITION: 18,000 ohms ±10%; 1/2 w	745-1405-00
R8	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R9	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
R10	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R11	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R12	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R13	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 1/2 w	745-1296-00
R14	DELETED	
R15	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R16	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 2 w	745-5701-00
R17	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R18	RESISTOR, FIXED, COMPOSITION: same as R7	745-1405-00
R19	RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±10%; 1/2 w	745-1436-00
R20	RESISTOR, FIXED, COMPOSITION: same as R5	745-5666-00
R21	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R22	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R23	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R24	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R25	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R26	RESISTOR, FIXED, COMPOSITION: same as R7	745-1405-00
R27	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R28	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%; 2 w	745-5677-00
R29	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-5701-00
R30	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R31	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R32	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R33	RESISTOR, FIXED, COMPOSITION: same as R5	745-5666-00
R34	RESISTOR, FIXED, COMPOSITION: 1 meg ±10%; 1/2 w	745-1478-00
R35	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1/2 w	745-1419-00
R36	RESISTOR, FIXED, COMPOSITION: same as R29	745-1394-00
R37	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R38	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%; 1/2 w	745-1328-00
R39	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%; 2 w	745-5673-00
R40	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R41 thru R54	NOT USED	
R55	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%; 1/2 w	745-1408-00
R56	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R57	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%; 1/2 w	745-1268-00
R58	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%; 1/2 w	745-1377-00
R59	RESISTOR, FIXED, COMPOSITION: 82 ohms ±10%; 1/2 w	745-1307-00
R60	RESISTOR, FIXED, COMPOSITION: 3.3 meg ±10%; 1/2 w	745-1499-00
R61	NOT USED	
R62	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R63	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 2 w	745-5596-00
R64	NOT USED	
R65	RESISTOR, FIXED, COMPOSITION: same as R16	745-5701-00
R66	NOT USED	
R67	RESISTOR, FIXED, WIRE WOUND: 4000 ohms, ±5%; 16 w	747-1712-00
S1	SWITCH SECTION, ROTARY: 4 moving and 9 fixed contacts (incl S16)	543-2920-002
S2	SWITCH SECTION, ROTARY: 2 moving and 7 fixed contacts includes capacitor	543-2933-002
S3	SWITCH SECTION, ROTARY: p o S2 fabricated	
S4	SWITCH SECTION, ROTARY: 4 moving and 7 fixed contacts (incl S5)	543-2866-002
S5	SWITCH SECTION, ROTARY: p o S4, fabricated	

ITEM	DESCRIPTION	COLLINS PART NUMBER
S6	SWITCH SECTION, ROTARY: 4 moving and 10 fixed contacts (incl S7)	543-2865-002
S7	SWITCH SECTION, ROTARY: p/o S6, fabricated	
S8	SWITCH SECTION, ROTARY: 1 moving and 5 fixed contacts	543-2864-002
S9	SWITCH SECTION, ROTARY: 1 moving and 4 fixed contacts	543-2863-002
S10	SWITCH SECTION, ROTARY: 4 moving and 10 fixed contacts (incl S11)	543-2862-002
S11	SWITCH SECTION, ROTARY: p/o S10, fabricated	
S12	SWITCH SECTION, ROTARY: 4 moving and 9 fixed contacts (incl S13)	543-2868-002
S13	SWITCH SECTION, ROTARY: p/o S12, fabricated	
S14	SWITCH SECTION, ROTARY: 3 moving and 4 fixed contacts includes 2 capacitors and 1 resistor	543-2934-002
S15	PLATE SWITCH: brass, 1/8 in. by 1-1/2 in. by 4-1/16 inch	543-9081-002
S16	SWITCH SECTION, ROTARY: p/o S1, fabricated	
S17	SWITCH SECTION, ROTARY: p/o S14, fabricated	
T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 300-kc frequency; interstage; incl mtg plate (incl T1A)	543-2930-002
T1A	TRANSFORMER, INTERMEDIATE FREQUENCY: 300-kc frequency; interstage (p/o T1)	278-0246-00
T2	TRANSFORMER, INTERMEDIATE FREQUENCY: 300-kc frequency; interstage; incl mtg plate (incl T2A)	543-2929-002
T2A	TRANSFORMER, INTERMEDIATE FREQUENCY: 300-kc frequency; interstage (p/o T2)	278-0294-00
T3	TRANSFORMER, INTERMEDIATE FREQUENCY: universal wound; 2 windings; 1.7 to 3.7 mc frequency range (p/o Z14)	543-2951-002
T4	COIL, RADIO FREQUENCY: same as L7 (p/o Z15)	543-2945-002
T5	COIL, RADIO FREQUENCY: same as L9 (p/o Z16)	543-2946-002
T6	COIL, RADIO FREQUENCY: same as L11 (p/o Z17)	543-2947-002
T7	COIL, RADIO FREQUENCY: universal wound; 66 turns Litz wire; 2 to 4 mc frequency range (p/o Z25)	543-1753-002
T8	COIL, RADIO FREQUENCY: single layer wound; 27 turns no. 36 AWG; 6 to 12 mc frequency range (p/o Z28)	543-2948-002
T9	COIL, RADIO FREQUENCY: same as L26 (p/o Z30)	543-2949-002
TB1	PRINTED CIRCUIT: plastic; incl 11 tubelets	543-2953-003
V1	ELECTRON TUBE: glass envelope; double triode type no. 5814A (p/o V1A and V1B)	253-0013-00
V2	ELECTRON TUBE: glass envelope; pentode type no. 5749	253-0005-00
V3	ELECTRON TUBE: same as V1 (c/o V3A and V3B)	253-0013-00
V4	ELECTRON TUBE: same as V2	253-0005-00
V5	ELECTRON TUBE: same as V2	253-0005-00
V6	ELECTRON TUBE: power pentode no. 6CL6	255-0216-00
V7	ELECTRON TUBE: same as V2	253-0005-00
V8	ELECTRON TUBE: same as V2	253-0005-00
V9	ELECTRON TUBE: glass envelope; pentode type 5654	253-0001-00
V10	ELECTRON TUBE: same as V2	253-0005-00
XV1	SOCKET, ELECTRON TUBE: 9 pin miniature	220-1293-00
XV2	SOCKET, ELECTRON TUBE: 7 pin miniature	220-1291-00
XV3	SOCKET, ELECTRON TUBE: same as XV1	220-1293-00
XV4	SOEKCT, ELECTRON TUBE: same as XV2	220-1291-00
XV5	SOCKET, ELECTRON TUBE: same as XV2	220-1291-00
XV6	SOCKET, ELECTRON TUBE: same as XV1	220-1293-00
XV7 thru XV10	SOCKET, ELECTRON TUBE: same as XV2	220-1291-00
Z1	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C2, C3, L1)	543-2978-003
Z2	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C6, C7, J2, L2)	543-2979-003
Z3	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C9, C10, L3)	543-2980-003
Z4	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C14, C16, L4)	543-2981-003
Z5	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C18, C19, J4, L5)	543-2982-003
Z6	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C20, C22, C24, L6)	543-2983-003
Z7	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C26, C29, L7)	543-2984-003
Z8	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C30, C31, L8)	543-2985-003
Z9	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C33, C34, L9)	543-2986-003
Z10	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C35, C36, L10)	543-2987-003
Z11	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C9, L11)	543-2988-003

ITEM	DESCRIPTION	COLLINS PART NUMBER
Z12	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C40, C41, L12)	543-2989-003
Z13	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C42, C43, L13)	543-2990-003
Z14	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C49, C50, C51, T3)	543-2991-003
Z15	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C52, C53, C54, T4)	543-2992-003
Z16	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C55, C56, C57, T5)	543-2993-003
Z17	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C58, C59, C60, T6)	543-2994-003
Z18	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C64, C65, L14)	544-2765-003
Z19	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C68, C69, L15)	544-2766-003
Z20	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C71, C72, C73, L16)	544-2767-003
Z21	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C77, C78, C79, L17)	543-2998-003
Z22	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C80, C81, C82, C83, L18)	543-2999-003
Z23	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C84, C85, C86, L19)	543-3000-003
Z24	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C87, C88, C89, L20)	543-3001-003
Z25	TUNING UNIT, RADIO FREQUENCY: 2 to 4 mc frequency range (incl C118, C119, C120, T7)	543-3002-003
Z26	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C125, C126, C127, C128, L25)	543-3003-003
Z27	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C129, C130, C131, L27)	543-3004-003
Z28	TUNING UNIT, RADIO FREQUENCY: 6 to 12 mc frequency range (incl C137, C138, C176, T8)	543-3005-003
Z29	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C140, C141, L29)	543-3006-003
Z30	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C148, C149, T9)	543-3007-003
	R-F TUNER, MODULE A4 (MODEL B)	546-2148-005
B1	MOTOR, DIRECT CURRENT: permanent magnet; 27.5 v dc, 0.120 amp OR	230-0364-00
B1	MOTOR, DIRECT CURRENT: same as B1	230-0323-00
C1	CAPACITOR, FIXED, CERAMIC: 10,000 uuf +100 -20%; 500 vdcw	913-3159-00
C2	CAPACITOR, FIXED, MICA: 130 uuf ±2%; 500 vdcw (p/o Z1)	912-1841-00
C3	CAPACITOR, VARIABLE, CERAMIC: 8.0 to 75.0 uuf; 350 vdcw (p/o Z1)	917-1122-00
C4	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C5	CAPACITOR, FIXED, CERAMIC: 4 uuf ±1/2 uuf; 500 vdcw	929-0026-00
C6	CAPACITOR, FIXED, MICA: 150 uuf ±2%; 500 vdcw (p/o Z2)	912-1844-00
C7	CAPACITOR, VARIABLE, CERAMIC: 8.0 to 75.0 uuf; 350 vdcw (p/o Z2)	917-1141-00
C8	CAPACITOR, FIXED, CERAMIC: same as C5	929-0026-00
C9	CAPACITOR, FIXED, MICA: same as C2 (p/o Z3)	912-1841-00
C10	CAPACITOR, VARIABLE, CERAMIC: same as C3 (p/o Z3)	917-1122-00
C11	CAPACITOR, FIXED, MICA: 100 uuf ±10%; 500 vdcw	912-0495-00
C12	CAPACITOR, FIXED, MICA: 43 uuf ±2%; 500 vdcw	912-1805-00
C13	CAPACITOR, FIXED, MICA: 20 uuf ±5%; 500 vdcw	912-1784-00
C14	CAPACITOR, FIXED, MICA: same as C2 (p/o Z4)	912-1841-00
C15	CAPACITOR, FIXED, CERAMIC: same as C5	929-0026-00
C16	CAPACITOR, VARIABLE, CERAMIC: same as C3 (p/o Z4)	917-1122-00
C17	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C18	CAPACITOR, FIXED, MICA: same as C6 (p/o Z5)	912-1844-00
C19	CAPACITOR, VARIABLE, CERAMIC: same as C7 (p/o Z5)	917-1141-00
C20	CAPACITOR, FIXED, CERAMIC: 75 uuf ±5%; 500 vdcw; w/ #9841 durez dip added (p/o Z6)	929-1954-00
C21	CAPACITOR, FIXED, CERAMIC: same as C5	929-0026-00
C22	CAPACITOR, FIXED, CERAMIC: 36 uuf ±5%; 500 vdcw; w/ #9841 durez dip added (p/o Z6)	929-1596-00
C23	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C24	CAPACITOR, VARIABLE, CERAMIC: same as C3 (p/o Z6)	917-1122-00
C25	CAPACITOR, FIXED, MICA: 36 uuf ±2%; 500 vdcw	912-1799-00
C26	CAPACITOR, FIXED, MICA: 300 uuf ±2%; 500 vdcw	912-1865-00
C27	CAPACITOR, FIXED, CERAMIC: 3.0 uuf ±1/2 uuf; 500 vdcw	929-0022-00
C28	CAPACITOR, FIXED, MICA: 56 uuf ±2%; 500 vdcw (p/o Z7)	912-1814-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C29	CAPACITOR, VARIABLE, CERAMIC: 5.0 uuf to 37.5 uuf; 350 vdcw (p/o Z7)	917-1121-00
C30	CAPACITOR, FIXED, CERAMIC: 56 uuf ±5%; 500 vdcw (p/o Z8)	929-1866-00
C31	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z8)	917-1121-00
C32	CAPACITOR, FIXED, CERAMIC: 1 uuf ±1/4 uuf; 500 vdcw	929-0008-00
C33	CAPACITOR, FIXED, MICA: same as C12 (p/o Z9)	912-1805-00
C34	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z9)	917-1121-00
C35	CAPACITOR, FIXED, CERAMIC: 39 uuf ±2%; 500 vdcw (p/o Z10)	929-1836-00
C36	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z10)	917-1121-00
C37	CAPACITOR, FIXED, CERAMIC: same as C32	929-0008-00
C38	CAPACITOR, FIXED, CERAMIC: same as C32	929-0008-00
C39	CAPACITOR, VARIABLE, CERAMIC: 3.0 to 18.0 uuf; 350 vdcw (p/o Z11)	917-1120-00
C40	CAPACITOR, FIXED, MICA: 30 uuf ±2%; 500 vdcw (p/o Z12)	912-1793-00
C41	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z12)	917-1120-00
C42	CAPACITOR, FIXED, CERAMIC: 5 uuf ±1/2 uuf; 500 vdcw (p/o Z13)	929-0560-00
C43	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z13)	917-1120-00
C44	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C45	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C46	CAPACITOR, FIXED, MICA: 12 uuf ±5%; 500 vdcw	912-1778-00
C47	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C48	CAPACITOR, FIXED, MICA: 22 uuf ±5%; 500 vdcw	912-1786-00
C49	CAPACITOR, FIXED, MICA: 150 uuf ±2%; 500 vdcw (p/o Z14)	912-1844-00
C50	CAPACITOR, FIXED, MICA: 680 uuf ±2%; 500 vdcw (p/o Z14)	912-3302-00
C51	CAPACITOR, VARIABLE, CERAMIC: same as C3 (p/o Z14)	917-1122-00
C52	CAPACITOR, FIXED, CERAMIC: 62 uuf ±5%; 500 vdcw (p/o Z15)	929-1940-00
C53	CAPACITOR, FIXED, MICA: 330 uuf ±2%; 500 vdcw (p/o Z15)	912-1868-00
C54	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z15)	917-1121-00
C55	CAPACITOR, FIXED, CERAMIC: 43 uuf ±5%; 500 vdcw (p/o Z16)	929-1794-00
C56	CAPACITOR, FIXED, MICA: 220 uuf ±2%; 500 vdcw (p/o Z16)	913-1856-00
C57	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z16)	917-1121-00
C58	CAPACITOR, FIXED, CERAMIC: same as C42 (p/o Z17)	929-0560-00
C59	CAPACITOR, FIXED, MICA: 24 uuf ±5%; 500 vdcw (p/o Z17)	912-1788-00
C60	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z17)	917-1120-00
C61	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C62	CAPACITOR, FIXED, MICA: 10 uuf ±5%; 500 vdcw	912-1776-00
C63	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C64	CAPACITOR, FIXED, MICA: 62 uuf ±2%; 500 vdcw (p/o Z18)	912-1820-00
C65	CAPACITOR, VARIABLE, CERAMIC: same as C29((p/o Z18)	917-1121-00
C66	CAPACITOR, FIXED, CERAMIC: 1.5 uuf ±1/4 uuf; 500 vdcw	929-0012-00
C67	CAPACITOR, FIXED, CERAMIC: 1000 uuf guaranteed min, value; 500 vdcw	913-1476-00
C68	CAPACITOR, FIXED, MICA: 82 uuf ±2%; 500 vdcw (p/o Z19)	912-1823-00
C69	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z19)	917-1121-00
C70	CAPACITOR, FIXED, CERAMIC: same as C66	929-0012-00
C71	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z20)	917-1121-00
C72	CAPACITOR, FIXED, MICA: same as C2 (p/o Z20)	912-1841-00
C73	CAPACITOR, FIXED, MICA: same as C2 (p/o Z20)	912-1841-00
C74	CAPACITOR, FIXED, PAPER: 100, 000 uuf ±20%; 100 vdcw	931-6541-00
C75	CAPACITOR, FIXED, PAPER: 100, 000 uuf ±20%; 400 vdcw	931-1651-00
C76	CAPACITOR, FIXED, PAPER: same as C75	931-1651-00
C77	CAPACITOR, VARIABLE, CERAMIC: same as C3 (p/o Z21)	917-1122-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C78	CAPACITOR, FIXED, MICA: same as C6 (p/o Z21)	912-1844-00
C79	CAPACITOR, FIXED, MICA: same as C50 (p/o Z21)	912-1871-00
C80	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z22)	917-1121-00
C81	CAPACITOR, FIXED, MICA: same as C68 (p/o Z22)	912-1823-00
C82	CAPACITOR, FIXED, MICA: 470 uuf ±2%; 300 vdcw (p/o Z22)	912-1880-00
C83	CAPACITOR, FIXED, MICA: same as C50 (p/o Z22)	912-1871-00
C84	CAPACITOR, VARIABLE, CERAMIC: same as C29 (p/o Z23)	917-1121-00
C85	CAPACITOR, FIXED, MICA: 51 uuf ±2%; 500 vdcw (p/o Z23)	912-1811-00
C86	CAPACITOR, FIXED, MICA: 430 uuf ±2%; 500 vdcw (p/o Z23)	912-1877-00
C87	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z24)	917-1120-00
C88	CAPACITOR, FIXED, MICA: same as C46 (p/o Z24)	912-1778-00
C89	CAPACITOR, FIXED, MICA: same as C56 (p/o Z24)	912-1856-00
C90	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C91	CAPACITOR, VARIABLE, CERAMIC: 8 to 50 uuf; 350 vdcw (p/o Z27)	917-1144-00
C92	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C93	CAPACITOR, FIXED, MICA: same as C25	912-1799-00
C94	CAPACITOR, FIXED, MICA: same as C13	912-1784-00
C95	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C96	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C97	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C98	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C99	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C100	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C101	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C102	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C103	NOT USED	
C104	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C105	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C106	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C107	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C108	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C109	CAPACITOR, FIXED, CERAMIC: 1000 uuf +100 -20%; 500 vdcw	913-3161-00
C110	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C111	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C112	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C113	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C114	NOT USED	
C115	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C116	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C117	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C118	CAPACITOR, FIXED, MICA: same as C50 (p/o Z25)	912-1871-00
C119	CAPACITOR, FIXED, MICA: same as C53 (p/o Z25)	912-1868-00
C120	CAPACITOR, VARIABLE, CERAMIC: same as C3((p/o Z25)	917-1122-00
C121	CAPACITOR, FIXED, MICA: same as C2	912-1841-00
C122	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C123	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C124	NOT USED	
C125	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z26)	917-1120-00
C126	CAPACITOR, FIXED, MICA: 510 uuf ±2%; 300 vdcw (p/o Z26)	912-1883-00
C127	CAPACITOR, FIXED, CERAMIC: 27 uuf ±2%; 500 vdcw (p/o Z26)	929-0506-00
C128	NOT USED	
C129	CAPACITOR, VARIABLE, CERAMIC: 3 to 12 uuf; 350 vdcw (p/o Z27)	917-1145-00
C130	CAPACITOR, FIXED, CERAMIC: 20 uuf ±5%; 500 vdcw (p/o Z27)	929-0616-00
C131	CAPACITOR, FIXED, MICA: same as C49 (p/o Z27)	912-1850-00
C132	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C133	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C134	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C135	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C136	NOT USED	
C137	CAPACITOR, FIXED, CERAMIC: 68 uuf ±2%; 500 vdcw (p/o Z28)	929-1876-00
C138	CAPACITOR, VARIABLE, CERAMIC: 5 to 25 uuf; 350 vdcw (p/o Z28)	917-1146-00
C139	CAPACITOR, FIXED, CERAMIC: 2 uuf ±1/4 uuf; 500 vdcw	929-0016-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C140	CAPACITOR, FIXED, CERAMIC: 24 uuf ±5%; 500 vdcw; w/ #9841 durez dip added (p/o Z29)	929-0502-00
C141	CAPACITOR, VARIABLE, CERAMIC: same as C39 (p/o Z29)	917-1120-00
C142	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C143	NOT USED	
C144	CAPACITOR, FIXED, CERAMIC: same as C139	929-0016-00
C145	CAPACITOR, FIXED, CERAMIC: 2 uuf ±1/2 uuf; 500 vdcw	929-0018-00
C146	CAPACITOR, FIXED, CERAMIC: 1.5 uuf ±1/2 uuf; 500 vdcw	929-0014-00
C147	NOT USED	
C148	CAPACITOR, FIXED, MICA: same as C25 (p/o Z30)	912-1799-00
C149	CAPACITOR, VARIABLE, CERAMIC: same as C39	917-1120-00
C150 thru C158	NOT USED	
C159 thru C169	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C170	NOT USED	
C171	CAPACITOR, FIXED, MICA: 240 uuf ±10%; 500 vdcw	912-0522-00
C172	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C173	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C174	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C175	CAPACITOR, FIXED, CERAMIC: same as C67	913-1476-00
C176	CAPACITOR, VARIABLE, CERAMIC: same as C91 (p/o Z28)	917-1144-00
C177	CAPACITOR, FIXED, MICA: same as C119	912-1868-00
C178	CAPACITOR, FIXED, MICA: 390 uuf ±2%; 500 vdcw	912-1874-00
C179	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C180	CAPACITOR, FIXED, MICA: same as C2	912-1841-00
C181	NOT USED	
C182	NOT USED	
C183	CAPACITOR, FIXED, CERAMIC: same as C1	913-3159-00
C184	CAPACITOR, FIXED, MICA: 5 uuf ±10%; 500 vdcw	912-1775-00
C185	CAPACITOR, FIXED, MICA: same as C13	912-1784-00
C186	CAPACITOR, FIXED, MICA: same as C25	912-1799-00
CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft type no. HD2123	353-0148-00
CR2	SEMICONDUCTOR DEVICE, DIODE: silicon, type no. 1N457	353-0204-00
CR3	SEMICONDUCTOR DEVICE, DIODE: same as CR2	353-0204-00
E1	SHIELD, ELECTRON TUBE: 9 pin medium; brass; incl copper insert	541-6554-003
E2	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6551-003
E3	SHIELD, ELECTRON TUBE: same as E1	541-6554-003
E4	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E5	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E6	SHIELD, ELECTRON TUBE: 9 pin noval; brass; incl copper insert	541-6555-003
E7	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E8	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E9	SHIELD, ELECTRON TUBE: 7 pin miniature; brass; incl copper insert	541-6550-003
E10	SHIELD, ELECTRON TUBE: same as E2	541-6551-003
E11 thru E15	TERMINAL, FEEDTHRU, INSULATED: brass conductor, teflon insulation	306-0323-00
E16	NOT USED	
E17 thru E20	TERMINAL, FEEDTHRU, INSULATED: same as E11	306-0323-00
E21	TERMINAL, STUD: tube pin type brass conductor; teflon insulation	306-0324-00
E22	JACK, TIP: std phone tip contact element accommodated; plastic insulation	360-0077-00
E23	TERMINAL, STUD: brass conductor; 0.218 in. dia by 0.489 in. lg overall (qty 15)	306-0322-00
E24	CORE, ADJUSTABLE TUNING: powdered iron; permeability 0.5 to 32 mc frequency range (qty 21)	288-2111-00
E25	TERMINAL, STUD: same as E21	306-0324-00
E26	TERMINAL, STUD: same as E21	306-0324-00
E27	TERMINAL, FEEDTHRU, INSULATED: brass hex, melamine, 2-56 NC-2, tap 5/64 in. deep, 13/32 in. lg	306-0348-00
E28	CORE, ADJUSTABLE TUNING: ferrite core; 0.5 to 32 mc frequency range	288-0030-00
H1	NUT, SELF-LOCKING, HEXAGON: type 303 passivated steel; 4-40 NC-2B thd, 3/8 in. lg by 1/4 in. across hex	543-2887-002
H2	NOT USED	
H3	SCREW, EXTERNALLY RELIEVED BODY: passivated steel; 8/32 NC-2A thd, 4 in. lg	543-2922-002
H4	SHIM: chromate dipped aluminum; 3/4 in. by 5/16 in. by 0.032 in. (qty 30)	543-2925-002

ITEM	DESCRIPTION	COLLINS PART NUMBER
J1 thru J16	JACK, TIP: std phone tip contact element accommodated; teflon insulation	360-0129-00
K1	RELAY, ARMATURE: 2C; 30 v dc at 2 amps resistive; 1 inductive winding, 27.5 v dc, 450 ohms, 0.06 amp approx	974-0449-00
K2	RELAY, ARMATURE: 2A, 1B; 28 v dc at 250 ma; 1 inductive winding, 26.5 v dc, 720 ohms 0.03 amp approx	974-0595-00
L1	COIL, RADIO FREQUENCY: universal wound; 1 winding of 66 turns; 1.7 to 3.7 mc frequency range (p/o Z1)	545-9073-002
L2	COIL, RADIO FREQUENCY: same as L1 (p/o Z2)	545-9073-002
L3	COIL, RADIO FREQUENCY: same as L1 (p/o Z3)	545-9073-002
L4	COIL, RADIO FREQUENCY: same as L1 (p/o Z4)	545-9073-002
L5	COIL, RADIO FREQUENCY: same as L1 (p/o Z5)	545-9073-002
L6	COIL, RADIO FREQUENCY: same as L1 (p/o Z6)	545-9073-002
L7	COIL, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (p/o Z7)	543-2945-002
L8	COIL, RADIO FREQUENCY: same as L7 (p/o Z8)	543-2945-002
L9	COIL, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (p/o Z9)	543-2946-002
L10	COIL, RADIO FREQUENCY: same as L9 (p/o Z10)	543-2946-002
L11	COIL, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (p/o Z11)	543-2947-002
L12	COIL, RADIO FREQUENCY: same as L11 (p/o Z12)	543-2947-002
L13	COIL, RADIO FREQUENCY: same as L11 (p/o Z13)	543-2947-002
L14	COIL, RADIO FREQUENCY: same as L7 (p/o Z18)	543-2945-002
L15	COIL, RADIO FREQUENCY: same as L7 (p/o Z19)	543-2945-002
L16	COIL, RADIO FREQUENCY: same as L7 (p/o Z20)	543-2945-002
L17	COIL, RADIO FREQUENCY: same as L1 (p/o Z21)	545-9073-002
L18	COIL, RADIO FREQUENCY: same as L7 (p/o Z22)	543-2945-002
L19	COIL, RADIO FREQUENCY: same as L9 (p/o Z23)	543-2946-002
L20	COIL, RADIO FREQUENCY: same as L11 (p/o Z24)	543-2947-002
L21 thru L25	COIL, RADIO FREQUENCY: universal wound, 3 pi, 216 total turns; 220 uh, 100 ma	240-0198-00
L26	COIL, RADIO FREQUENCY: 14 to 28 mc frequency range (p/o Z26)	543-2949-002
L27	COIL, RADIO FREQUENCY: same as L26 (p/o Z27)	543-2949-002
L28	NOT USED	
L29	COIL, RADIO FREQUENCY: same as L26 (p/o Z29)	543-2949-002
L30	NOT USED	
L31	NOT USED	
L32	COIL, RADIO FREQUENCY: universal wound, 3 pi, 38 AWG; 1 mh, 60 ma	240-0313-00
L33	COIL, RADIO FREQUENCY: same as L32	240-0313-00
L34	COIL, RADIO FREQUENCY: single layer wound; magnet wire; 39 uh inductance, 2.00 ohms dc; 500 ma current	240-0171-00
L35	NOT USED	
L36	COIL, RADIO FREQUENCY: 1 winding, single layer wound; enamel or formvar magnet wire; 3.30 uh, ±10% at 7.9 mc; 0.15 ohms dc; 1470 ma current	240-0065-00
L37	COIL, RADIO FREQUENCY: same as L34	240-0171-00
MP1 thru MP4	PULLEY, FLAT: c/o needle bearing and flat pulley; 0.593 in. od by 0.453 in. thk approx	543-2880-002
MP5	PULLEY, FLAT: c/o needle bearing and flat pulley; 1.122 in. dia by 0.453 in. thk approx	543-2882-002
MP6	PULLEY, FLAT: same as MP5	543-2882-002
MP7	SPRING, HELICAL, EXTENSION: type 302 stainless steel; wire 0.050 in. dia; 5/16 in. od; 2-1/2 in. max spring extension	543-2888-002
MP8	SPRING, HELICAL, EXTENSION: same as MP7	543-2888-002
MP9	SHAFT, SWITCH: glass bonded mica; 0.187 in. dia by 8.764 in. lg overall	543-2910-002
MP10	SHAFT, DRIVE, FLEXIBLE: steel passivated 12.311 in. lg by 1.095 in. dia approx; grooved and chamfered	543-2964-003
MP11	COUPLER, SHAFT: plastic; incl roll pin; 3/8 in. dia by 7/16 in. lg	548-1284-00
MP12	BEARING, BALL, ANNULAR: single row, radial; 0.422 in. od, 0.2500 in. id, 0.125 in. lg	309-0662-00
MP13	BEARING, BALL, ANNULAR: same as MP12	309-0662-00
MP14	SPRING, LOCKING: type 302 stainless steel wire; 0.030 in. dia; 0.030 in. by 0.224 in. by 0.310 in. (qty 30)	502-6005-002
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts, 1000 v ac and dc, 5 amps; straight	371-0020-00
P2	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 rd male contacts, 1700 v dc, 5 amps; straight	371-0283-00
R1	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R2	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R3	RESISTOR, FIXED, COMPOSITION: 470, 000 ohms ±10%; 1/2 w	745-1464-00
R4	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%; 1/2 w	745-1314-00
R5	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 2 w	745-5666-00
R6	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-3352-00
R7	RESISTOR, FIXED, COMPOSITION: 18, 000 ohms ±10%; 1/2 w	745-1405-00
R8	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R9	RESISTOR, FIXED, COMPOSITION: 68 ohms ±10%; 1/2 w	745-1303-00
R10	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R11	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R12	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R13	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 1/2 w	745-1296-00
R14	NOT USED	
R15	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R16	RESISTOR, FIXED, COMPOSITION: 15, 000 ohms ±10%; 2 w	745-5701-00
R17	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R18	RESISTOR, FIXED, COMPOSITION: same as R7	745-1405-00
R19	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms ±10%; 1/2 w	745-1436-00
R20	RESISTOR, FIXED, COMPOSITION: same as R5	745-5666-00
R21	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R22	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R23	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R24	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R25	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R26	RESISTOR, FIXED, COMPOSITION: same as R7	745-1405-00
R27	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R28	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%; 2 w	745-5677-00
R29	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%; 1/2 w	745-5701-00
R30	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R31	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R32	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R33	RESISTOR, FIXED, COMPOSITION: same as R5	745-5666-00
R34	RESISTOR, FIXED, COMPOSITION: 1 meg ±10%; 1/2 w	745-1478-00
R35	RESISTOR, FIXED, COMPOSITION: 0.15 megohms ±10%; 1/2 w	745-1443-00
R36	RESISTOR, FIXED, COMPOSITION: same as R29	745-1394-00
R37	RESISTOR, FIXED, COMPOSITION: same as R3	745-1464-00
R38	RESISTOR, FIXED, COMPOSITION: 270 ohms ±10%; 1/2 w	745-1328-00
R39	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%; 2 w	745-5673-00
R40	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R41 thru R54	NOT USED	
R55	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms ±10%; 1/2 w	745-1408-00
R56	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R57	RESISTOR, FIXED, COMPOSITION: 10 ohms ±10%; 1/2 w	745-1268-00
R58	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%; 1/2 w	745-1377-00
R59	RESISTOR, FIXED, COMPOSITION: 82 ohms ±10%; 1/2 w	745-1307-00
R60	RESISTOR, FIXED, COMPOSITION: 3.3 megohms ±10%; 1/2 w	745-1499-00
R61	NOT USED	
R62	RESISTOR, FIXED, COMPOSITION: same as R9	745-1303-00
R63	RESISTOR, FIXED, COMPOSITION: 47 ohms ±10%; 2 w	745-5596-00
R64	NOT USED	
R65	RESISTOR, FIXED, COMPOSITION: same as R16	745-5701-00
R66	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10% 1/2 w	745-1380-00
R67	RESISTOR, FIXED, WIRE WOUND: 4000 ohms ±5%; 16 w	747-1712-00
S1	SWITCH SECTION, ROTARY: 4 moving and 9 fixed contacts (incl S16)	543-2920-002
S2	SWITCH SECTION, ROTARY: 2 moving and 7 fixed contacts (incl S3)	543-2933-002
S3	SWITCH SECTION, ROTARY: p o S2 fabricated	
S4	SWITCH SECTION, ROTARY: 4 moving and 7 fixed contacts (incl S5)	543-2866-002
S5	SWITCH SECTION, ROTARY: p. o S4, fabricated	
S6	SWITCH SECTION, ROTARY: 4 moving and 10 fixed contacts (incl S7)	543-2865-002
S7	SWITCH SECTION, ROTARY: p/o S6. fabricated	543-2864-002
S8	SWITCH SECTION, ROTARY: 1 moving and 5 fixed contacts	543-2864-002
S9	SWITCH SECTION, ROTARY: 1 moving and 4 fixed contacts	543-2863-002
S10	SWITCH SECTION, ROTARY: 4 moving and 10 fixed contacts (incl S11)	543-2862-002
S11	SWITCH SECTION, ROTARY: p/o S10, fabricated	
S12	SWITCH SECTION, ROTARY: 4 moving and 9 fixed contacts (incl S13)	543-2868-002
S13	SWITCH SECTION, ROTARY: p/o S12, fabricated	
S14	SWITCH SECTION, ROTARY: 3 moving and 4 fixed contacts (incl S17)	543-2934-002
S15	SWITCH SECTION, ROTARY: 1 moving and 4 fixed contacts, 3 eyelets	545-9071-002
S16	SWITCH SECTION, ROTARY: p/o S1, fabricated	
S17	SWITCH SECTION, ROTARY: p/o S14, fabricated	
T1	TRANSFORMER, INTERMEDIATE FREQUENCY: 300 kc freq; interstage; incl mtg plate (incl T1A)	543-2930-002
T1A	TRANSFORMER, INTERMEDIATE FREQUENCY: 300 kc frequency; interstage (p/o T1)	278-0246-00
T2	TRANSFORMER, INTERMEDIATE FREQUENCY: 300 kc freq; interstage; incl mtg plate (incl T2A)	543-2929-002
T2A	TRANSFORMER, INTERMEDIATE FREQUENCY: 300 kc frequency; interstage (p/o T2)	278-0294-00
T3	TRANSFORMER, INTERMEDIATE FREQUENCY: universal wound; 1 winding of 66 turns; 1 winding of 4 turns; 1.7 to 3.7 mc frequency range (p/o Z14)	545-9073-002
T4	COIL, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range	543-2945-002
T5	COIL, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (p/o Z16)	543-2946-002
T6	COIL, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (p/o Z17)	543-2947-002
T7	TRANSFORMER, INTERMEDIATE FREQUENCY: universal wound; 1 winding of 60 turns and one winding of 5 turns (p/o Z25)	545-9072-002
T8	COIL, RADIO FREQUENCY: single layer wound; 27 turns no. 36 AWG; 6 to 12 mc frequency range (p/o Z28)	543-2948-002
T9	COIL, RADIO FREQUENCY: 14 to 28 mc frequency range	543-2949-002
TB1	PRINTED CIRCUIT: plastic; incl 11 tubelets	543-2953-003
V1	ELECTRON TUBE: glass envelope; double triode type no. 5814A (c/o V1A and V1B)	253-0013-00
V2	ELECTRON TUBE: glass envelope; pentode type 5749	253-0005-00
V3	ELECTRON TUBE: same as V1 (c/o V3A and V3B)	253-0013-00
V4	ELECTRON TUBE: same as V2	253-0005-00
V5	ELECTRON TUBE: same as V2	253-0005-00
V6	ELECTRON TUBE: power pentode no. 6CL6	255-0216-00
V7	ELECTRON TUBE: same as V2	253-0005-00
V8	ELECTRON TUBE: same as V2	253-0005-00
V9	ELECTRON TUBE: glass envelope; pentode type 5654	253-0001-00
V10	ELECTRON TUBE: same as V2	253-0005-00
XV1	SOCKET, ELECTRON TUBE: 9 pin miniature	220-1293-00
XV2	SOCKET, ELECTRON TUBE: 7 pin miniature	220-1291-00
XV3	SOCKET, ELECTRON TUBE: same as XV1	220-1293-00
XV4	SOCKET, ELECTRON TUBE: same as XV2	220-1291-00
XV5	SOCKET, ELECTRON TUBE: same as XV2	220-1291-00
XV6	SOCKET, ELECTRON TUBE: same as XV1	220-1293-00
XV7 thru XV10	SOCKET, ELECTRON TUBE: same as XV2	220-1291-00
Z1	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C3, C2, L1)	545-9074-003
Z2	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C6, C7, L2)	545-9075-003
Z3	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C9, C10, L3)	545-9076-003
Z4	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C14, C16, L4)	545-9077-003
Z5	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C18, C19, L5)	545-9078-003
Z6	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C20, C22, C24, L6)	545-9079-003
Z7	TUNING UNIT, RADIO FREQUENCY: 3. 7 to 7.7 mc frequency range (incl C28, C29, L7)	543-2984-003
Z8	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C30, C31, L8)	543-2985-003
Z9	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C33, C34, L9)	543-2986-003
Z10	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C35, C36, L10)	543-2987-003
Z11	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C39, L11)	543-2988-003
Z12	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C40, C41, L12)	543-2989-003

ITEM	DESCRIPTION	COLLINS PART NUMBER
Z13	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C42, C43, L13)	543-2990-003
Z14	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C49, C50, C51, T3)	545-9080-003
Z15	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C52, C53, C54)	545-9081-003
Z16	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C55, C56, C57, T5)	543-2993-003
Z17	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C58, C59, C60, T6)	543-2994-003
Z18	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C64, C65, L14)	544-2765-003
Z19	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C68, C69, L15)	544-2766-003
Z20	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C71, C72, C73, L16)	544-2767-003
Z21	TUNING UNIT, RADIO FREQUENCY: 1.7 to 3.7 mc frequency range (incl C77, C78, C79, L17)	545-9082-003
Z22	TUNING UNIT, RADIO FREQUENCY: 3.7 to 7.7 mc frequency range (incl C80, C81, C82, C83, L18)	543-2999-003
Z23	TUNING UNIT, RADIO FREQUENCY: 7.7 to 15.7 mc frequency range (incl C84, C85, C86, L19)	543-3000-003
Z24	TUNING UNIT, RADIO FREQUENCY: 15.7 to 31.7 mc frequency range (incl C87, C88, C89, L20)	543-3001-003
Z25	TUNING UNIT, RADIO FREQUENCY: 2 to 4 mc frequency range (incl C118, C119, C120, T7)	545-9083-003
Z26	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C126, C127, C125, L26)	545-9084-003
Z27	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C129, C130, C131, L27, C91)	543-3004-003
Z28	TUNING UNIT, RADIO FREQUENCY: 6 to 12 mc frequency range (incl C137, C138, C176, T8)	543-3005-003
Z29	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C140, C141, L29)	543-3006-003
Z30	TUNING UNIT, RADIO FREQUENCY: 14 to 28 mc frequency range (incl C148)	545-9085-003
	REFERENCE OSCILLATOR, MODULE A5	542-7729-004
C1	CAPACITOR, FIXED, GLASS DIELECTRIC: 300 v dc working; 1000 uuf ±5%	914-0548-00
C2	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 47, 000 uuf ±5%	931-4993-00
C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 v dc working; 82 uuf ±1%	929-2330-00
C4	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C5	CAPACITOR, FIXED, GLASS DIELECTRIC: 300 v dcworking; 680 uuf ±5%	914-0547-00
C6	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working, 100 uuf ±2%	912-1832-00
C7	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C8	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1832-00
C9	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 130 uuf ±2%	912-1841-00
C10	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C11	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 350 v dc working; 8.0 to 50 uuf	917-1159-00
C12	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1832-00
C13	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C14	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C15	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 200 uuf ±2%	912-1853-00
C16	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C17	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C11	917-1159-00
C18	CAPACITOR, FIXED, ELECTROLYTIC: 24 v dc working; 20 uuf +75%; -15%	184-7233-00
C19	CAPACITOR, FIXED, ELECTROLYTIC: same as C18	184-7233-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 4700 uuf ±10%	912-2712-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 5100 uuf ±10%	912-2715-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 5600 uuf ±10%	912-2718-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 6200 uuf ±10%	912-2721-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 6800 uuf ±10%	912-2724-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 7500 uuf ±10%	912-2727-00
*C20	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 8200 uuf ±10%	912-2730-00
*C20	CAPACITOR, FIXED, MICA: 9100 uuf ±10%, 500 v dc	912-2733-00
*C20	CAPACITOR, FIXED, MICA: 10, 000 uuf ±10%, 500 v dc	912-2736-00
C21	CAPACITOR, FIXED, ELECTROLYTIC: 50 v dc working; 50 uf +75% -15%	184-7240-00
C22	CAPACITOR, FIXED, PAPER DIELECTRIC: 100 v dc working; 10, 000 uuf ±5%	931-4988-00
C23	CAPACITOR, FIXED, INSULATED CERAMIC DIELECTRIC: 100 v dc working; 3300 uuf, ±20%	913-3025-00
C24	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 30 uuf ±2%	912-1793-00
C25	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1832-00
C26	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C11	917-1159-00
C27	CAPACITOR, FIXED, INSULATED CERAMIC DIELECTRIC: same as C23	913-3025-00
C28	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1832-00
C29	CAPACITOR, FIXED, MICA DIELECTRIC: same as C5	914-0547-00
C30	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C11	917-1159-00
C31	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 47 uuf ±2%	912-1808-00
C32	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C33	CAPACITOR, FIXED, MICA DIELECTRIC: same as C6	912-1832-00
C34	CAPACITOR, FIXED, MICA DIELECTRIC: same as C5	914-0547-00
C35	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C22	931-4988-00
*C35	CAPACITOR, FIXED, PAPER DIELECTRIC: same as C22	931-4988-00
*C35	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc, working .0068 uf ±20%	931-4502-00
*C35	CAPACITOR, FIXED, PAPER DIELECTRIC: 200 v dc working .0047 uf ±20%	931-5036-00
*C35	CAPACITOR, FIXED PAPER DIELECTRIC: 200 v dc working .0056 uf ±20%	931-4501-00
C36	CAPACITOR, FIXED, GLASS DIELECTRIC: same as C1	914-0548-00
C37	CAPACITOR, FIXED, PAPER DIELECTRIC: 8200 uuf	931-5035-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 300 uuf ±2%	912-1865-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 330 uuf ±2%	912-1868-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 360 uuf ±2%	912-1871-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 500 v dc working; 390 uuf ±2%	912-1874-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 430 uuf ±2%	912-1877-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: 300 v dc working; 470 uuf ±2%	912-1880-00
*C38	CAPACITOR, FIXED, MICA DIELECTRIC: same as C29	912-1883-00
*C38	CAPACITOR, FIXED, MICA: same as C29	912-1883-00
*C38	CAPACITOR, FIXED, MICA: same as C5	914-0547-00
CB1	SWITCH, THERMOSTATIC: spst; contacts open on temp increase; 60°C temp setting; bimetal element; 115 v ac at 2.5 amp; 28 v dc at 2.5 amp	292-0130-00
CR1	SEMICONDUCTOR DEVICE, DIODE: germanium; General Electric type 1N91	353-1010-00
CR2	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-1010-00
CR3	SEMICONDUCTOR DEVICE, DIODE: silicon; Hoffman Electronics part no. 1N721A	353-2741-00
E1	TERMINAL, FEEDTHRU, INSULATED: tube pin type brass conductor; teflon insulation	306-0323-00
E2	TERMINAL, STUD: tube pin type brass conductor teflon insulation	306-0324-00
E3	TERMINAL, FEEDTHRU, INSULATED: same as E1	306-0323-00
E4	TERMINAL, FEEDTHRU, INSULATED: same as E1	306-0323-00
E5	TERMINAL, STUD: same as E2	306-0324-00
E6	TERMINAL, STUD: same as E2	306-0324-00
E7	TERMINAL, FEEDTHRU, INSULATED: same as E1	306-0323-00

*Chosen per operational requirement

ITEM	DESCRIPTION	COLLINS PART NUMBER
E8	TERMINAL, STUD: same as E2	306-0324-00
E9	TERMINAL, FEEDTHRU, INSULATED: same as E1	306-0323-00
E10	TERMINAL, FEEDTHRU, INSULATED: same as E1	306-0323-00
E11 thru E14	TERMINAL, STUD: same as E2	306-0324-00
E15	PRINTED CIRCUIT: plastic board; incl 6 terminals and 154 tubelets	544-5648-00
HR1	OVEN, CRYSTAL: 80 deg C ±2 deg C; 4 windings; 58 turns ea; 4 solder lug terminals (incl R9, R10, R11, R12, Y1)	542-7288-002
L1	COIL, RADIO FREQUENCY: universal pi wound; 40 turns 7 strand #44 AWG; 4 to 10 uh at 3.0 mc	542-7294-002
L2	COIL, RADIO FREQUENCY: universal wound, 3 pi, 336 total turns no. 36 AWG; 500 uh, 4.3 ohms. 100 ma	240-0073-00
L3	COIL, RADIO FREQUENCY: same as L2	240-0073-00
L4	COIL, RADIO FREQUENCY: toroidal wound; 10 mh. 100 kc	240-0892-00
L5	COIL, RADIO FREQUENCY: single layer wound magnet wire; 100 uh, 2.80 ohms max dc; 500 ma max	240-0193-00
L6	COIL, RADIO FREQUENCY: universal wound, 3 pi, 38 AWG; 1 mh, 60 ma	240-0313-00
L7	COIL, RADIO FREQUENCY: universal wound pi sections; no. 40 AWG; 2.0 mh, 100 uuf, 35 ma	240-0084-00
P1	CONNECTOR, PLUG, ELECTRICAL: printed circuit plug feedthru, p/o 100-kc Ref Oscillator, built in	
Q1	TRANSISTOR: germanium; Minneapolis Honeywell Co. part no. 2N540	352-0026-00
Q2	TRANSISTOR: same as Q1	352-0026-00
Q3	TRANSISTOR: germanium; General Electric Co. type no. 2N527	352-0124-00
Q4	TRANSISTOR: same as Q1	352-0026-00
Q5 thru Q12	TRANSISTOR: germanium; Philco type no 2N499	352-0091-00
Q13	TRANSISTOR: silicon; Texas Instruments Co. 2N264	352-0087-00
R1	RESISTOR, FIXED, COMPOSITION: 22 ohms ±10%; 1 w	745-3282-00
R2	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 1/2 w	745-1310-00
R3	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%; 1/2 w	745-1380-00
R4	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%; 1/2 w	745-1387-00
R5	RESISTOR, FIXED, COMPOSITION: same as R2	745-1296-00
R6	RESISTOR, FIXED, WIREWOUND: 5 ohms ±5%; 2.5 w	747-5314-00
R7	RESISTOR, FIXED, WIREWOUND: 10 ohms ±5%; 3 w	747-5114-00
R8	RESISTOR, FIXED, WIREWOUND: same as R7	747-5114-00
R9	RESISTOR: 47 ohms; p/o HR1, built in	
R10	RESISTOR: p/o HR1, built in; same as R9	
R11	RESISTOR: p/o HR1, built in; same as R9	
R12	RESISTOR: p/o HR1, built in; same as R9	
R13	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R14	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%; 1/2 w	745-1419-00
R15	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R16	RESISTOR, FIXED, COMPOSITION: same as R14	745-1419-00
R17	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%; 1/2 w	745-1352-00
R18	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R19	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms ±10%; 1/2 w	745-1436-00
R20	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms ±10%; 1/2 w	745-1394-00
R21	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1370-00
R22	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 1/2 w	745-1384-00
R23	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R24	RESISTOR, FIXED, COMPOSITION: same as R14	745-1419-00
R25	RESISTOR, FIXED, COMPOSITION: same as R17	745-1352-00
R26	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R27	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R28	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±5%; 1/2 w	745-1379-00
R29	RESISTOR, FIXED, WIREWOUND: 7500 ohms ±3%, 5 w	747-9399-00
R30	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±5%; 1/2 w	745-1351-00
R31	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R32	RESISTOR, FIXED, COMPOSITION: same as R19	745-1436-00
R33	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R34	RESISTOR, FIXED, COMPOSITION: 220, 000 ohms ±10%; 1/2 w	745-1450-00
R35	RESISTOR, FIXED, COMPOSITION: same as R3	745-1380-00
R36	RESISTOR, FIXED, COMPOSITION: 18, 000 ohms ±10%; 1/2 w	745-1405-00
R37	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 1/2 w	745-1366-00
R38	RESISTOR, FIXED, COMPOSITION: same as R20	745-1394-00
R39	RESISTOR, FIXED, COMPOSITION: same as R17	745-1352-00
R40	RESISTOR, FIXED, COMPOSITION: 2200 ohms ±10%; 1/2 w	745-1366-00
T1	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 250 ohms, 80 ma dc, primary; 500 ohms center tapped secondary; 1 w max output; 5 kc frequency	677-0924-00
T2	TRANSFORMER, AUDIO FREQUENCY: input type; 25 v ac, 20 ma dc primary; 5 v ac, 10 ma dc secondary; 5-kc frequency	677-0945-00
T3	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; 125 ohms center tapped, 100 ma dc primary; 50 ohms center tapped secondary; 10 w max output; 5-kc frequency	677-0934-00
Y1	CRYSTAL UNIT, QUARTZ: 1 plate, 3.000 kc (p/o HR1)	290-5430-00
Z1	REFERENCE SIGNAL GENERATOR SUBASSEMLY: c/o 1 inductor, 9 transistors, 1 circuit board and hardware	544-5646-003
Z2	OVEN, CRYSTAL: 80°C ±0.1°C	542-7288-002
	ISOLATION AMPLIFIER, MODULE A5	543-6255-004
C1	CAPACITOR, FIXED, MICA DIELECTRIC: 470 uuf, ±2%; 300 v dc working	912-0541-00
C2	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 0.02 uf, +100% -20%; 500 v dc working	913-2142-00
C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10, 000 uuf +100% -20%; 500 v dc working	913-1188-00
C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C2	913-2142-00
C5	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 8 uuf min 75 uuf max, 350 v dc working	917-1075-00
C6	CAPACITOR, FIXED, MICA DIELECTRIC: 430 uuf, ±2%; 300 v dc working	912-0538-00
C7	CAPACITOR, FIXED, MICA DIELECTRIC: 4700 uuf, ±10%; 500 v dc working	935-2103-00
C8	CAPACITOR, FIXED, MICA DIELECTRIC: same as C7	935-2103-00
C9	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C3	913-1188-00
C10	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C3	913-1188-00
C11	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: 5 uuf min, 37.5 uuf max; 350 v dc working	917-1073-00
C12	CAPACITOR, FIXED, MICA DIELECTRIC: 24 uuf, ±5%; 500 v dc working	912-0449-00
C13	CAPACITOR, FIXED, MICA DIELECTRIC: 150 uuf, ±2%; 500 v dc working	912-0505-00
C14	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C3	913-1188-00
C15	CAPACITOR, VARIABLE, CERAMIC DIELECTRIC: same as C5	917-1075-00
C16	CAPACITOR, FIXED, MICA DIELECTRIC: 39 uuf, ±2%; 500 v dc working	912-0463-00
C17	NOT USED	
C18	CAPACITOR, FIXED, MICA DIELECTRIC: 330 uuf, ±2%; 500 v dc working	912-0529-00
C19	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C3	913-1188-00
C20	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as C3	913-1188-00
C21	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, ±2%; 500 v dc working	912-0493-00
E1	SHIELD, ELECTRON TUBE: 7 pin medium; brass; incl copper insert and hold-down spring; Collins Radio Company	541-6551-003
E2	SHIELD, ELECTRON TUBE: same as E1	541-6551-003
E3	SHIELD, ELECTRON TUBE: same as E1	541-6551-003
J1 thru J5	JACK, TIP: one female contact; use w/ 0.089 in. dia male contact; 1250 v rms 60 cps	360-0087-00
L1	REACTOR: 5.0 uh, ±1% inductance; 200-kc frequency	240-0594-00
L2	REACTOR: 1.0 uf, ±1% inductance; 600-kc frequency; 500 test v	240-0591-00
L3	REACTOR: 50 uh, ±1% inductance; 2.4-mc frequency	240-0593-00
R1	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%; 1/2 w	745-1352-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R2	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms, ±10%; 1/2 w	745-1436-00
R3	RESISTOR, FIXED, COMPOSITION: 27, 000 ohms, ±10%; 1/2 w	745-1412-00
R4	RESISTOR, FIXED, COMPOSITION: same as R2	745-1436-00
R5	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R6	RESISTOR, FIXED, COMPOSITION: same as R2	745-1436-00
R7	RESISTOR, FIXED, COMPOSITION: same as R2	745-1436-00
R8	RESISTOR, FIXED, COMPOSITION: same as R1	745-1352-00
R9	RESISTOR, FIXED, COMPOSITION: 470, 000 ohms, ±10%; 1/2 w	745-1464-00
R10	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms, ±10%; 1/2 w	745-1394-00
V1	TUBE, ELECTRON: pentode type 6AU6	255-0202-00
V2	TUBE, ELECTRON: same as V1	255-0202-00
V3	TUBE, ELECTRON: same as V1	255-0202-00
XV1	SOCKET, ELECTRON TUBE: 7 pin miniature	220-1291-00
XV2	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00
XV3	SOCKET, ELECTRON TUBE: same as XV1	220-1291-00

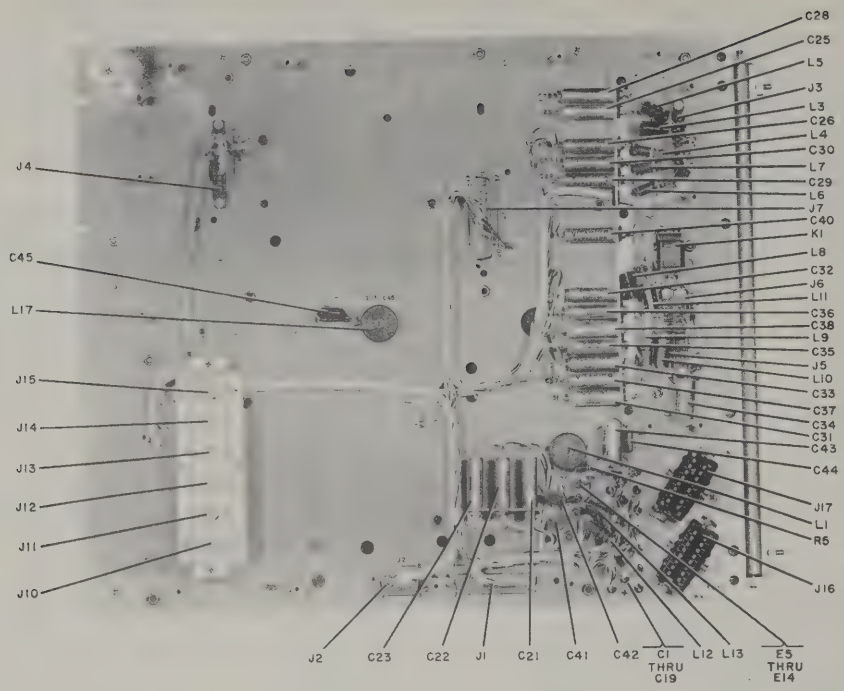


Figure 4-1. Frequency Generator 786E-1, Rear View with Cover Removed

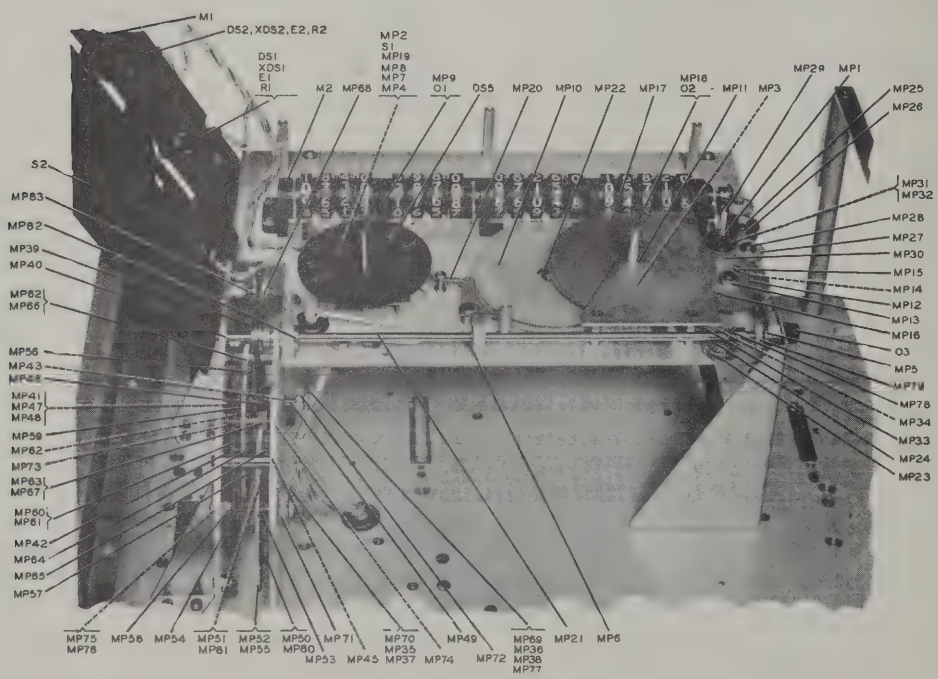


Figure 4-2. Frequency Generator 786E-1, Front View

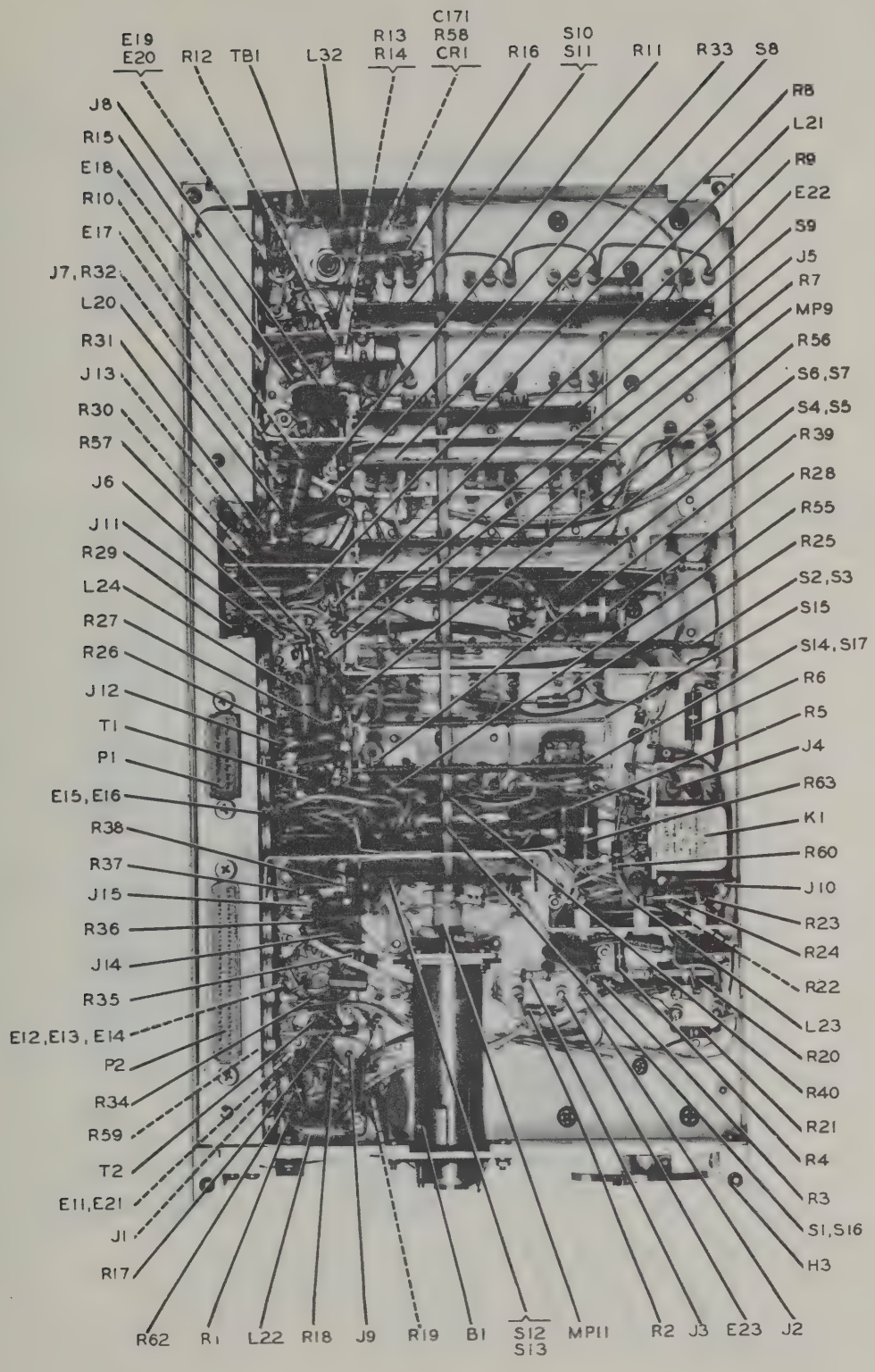


Figure 4-3. R-F Tuner Module, Rear View

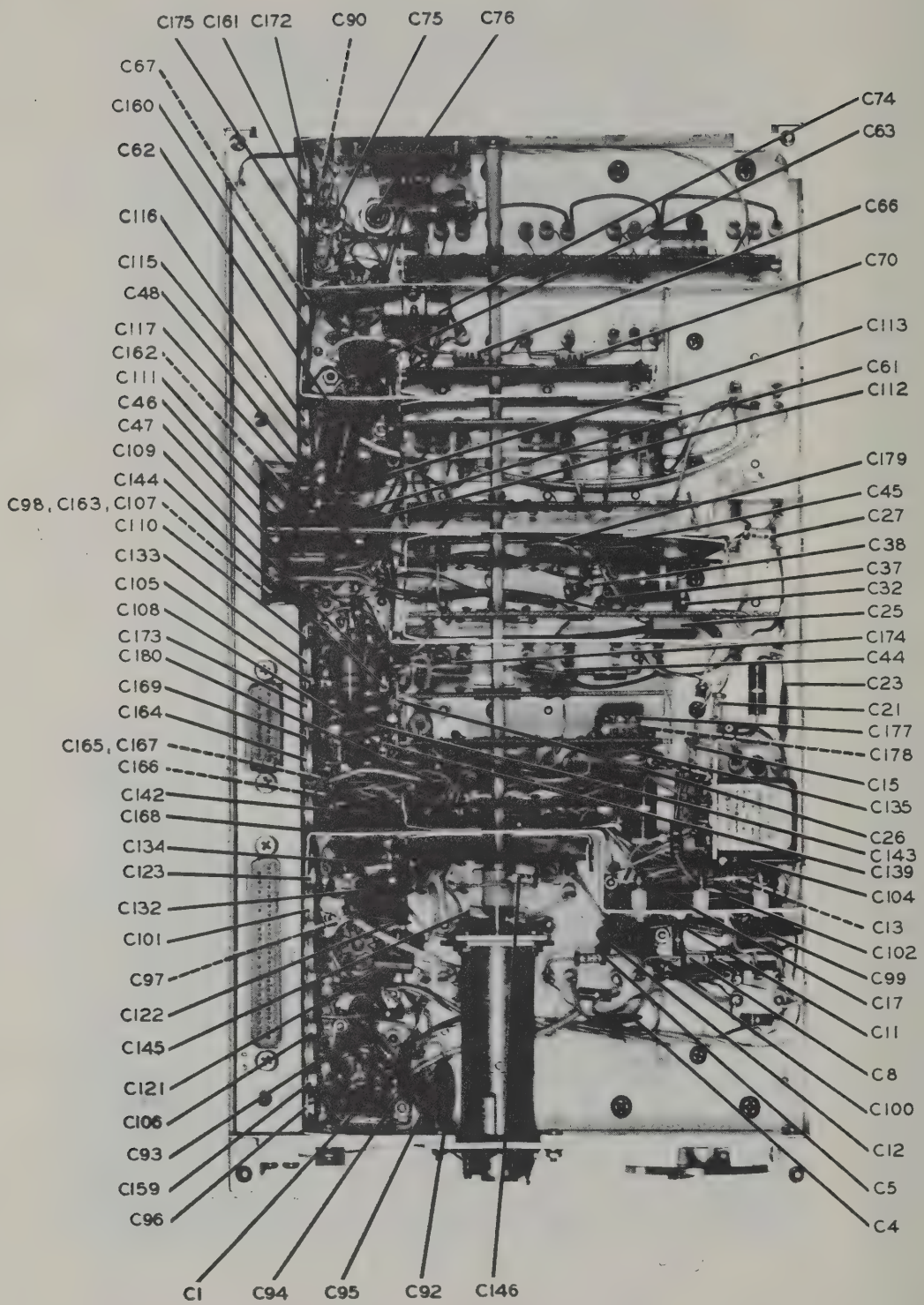


Figure 4-4. R-F Tuner Module, Rear View

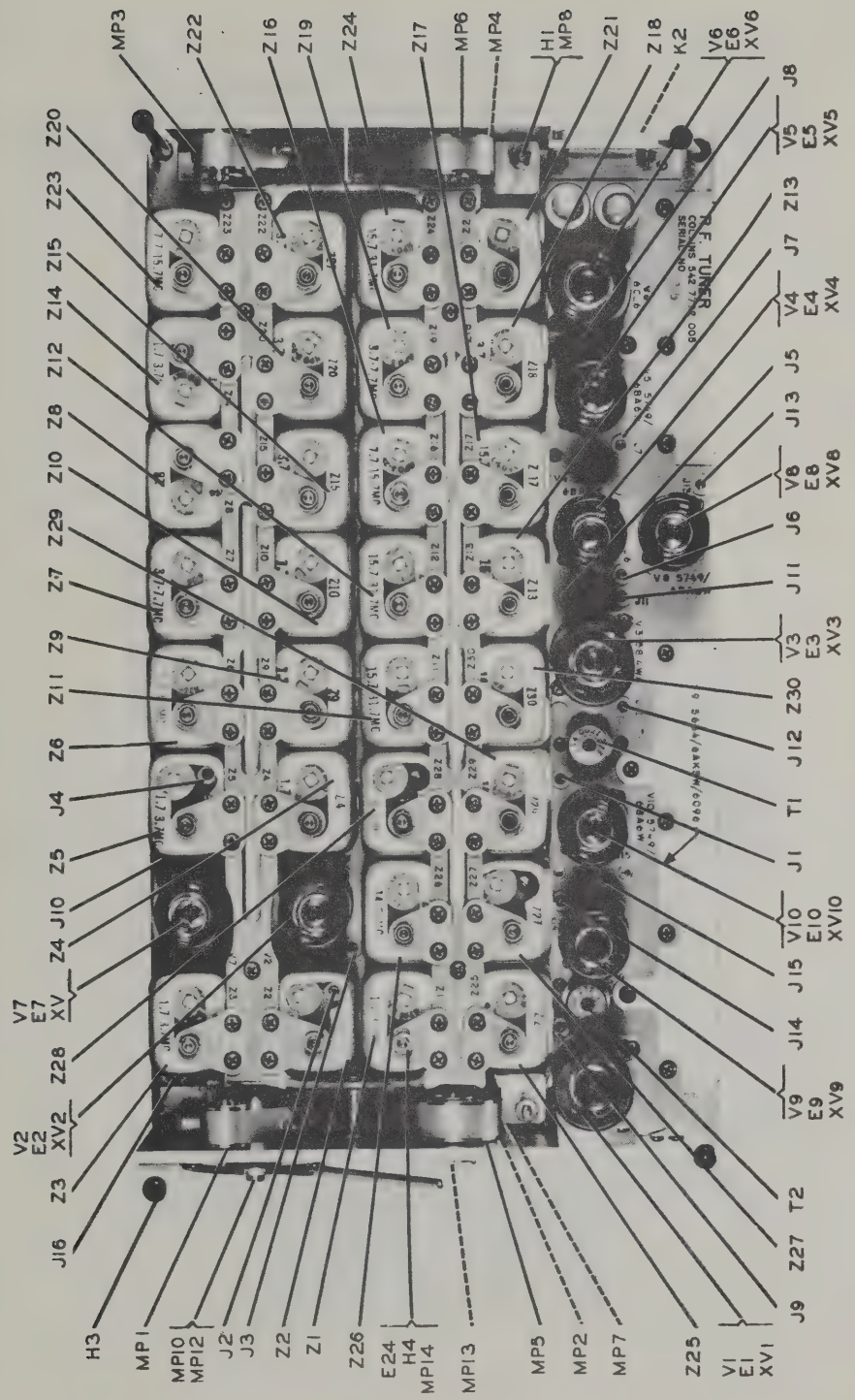
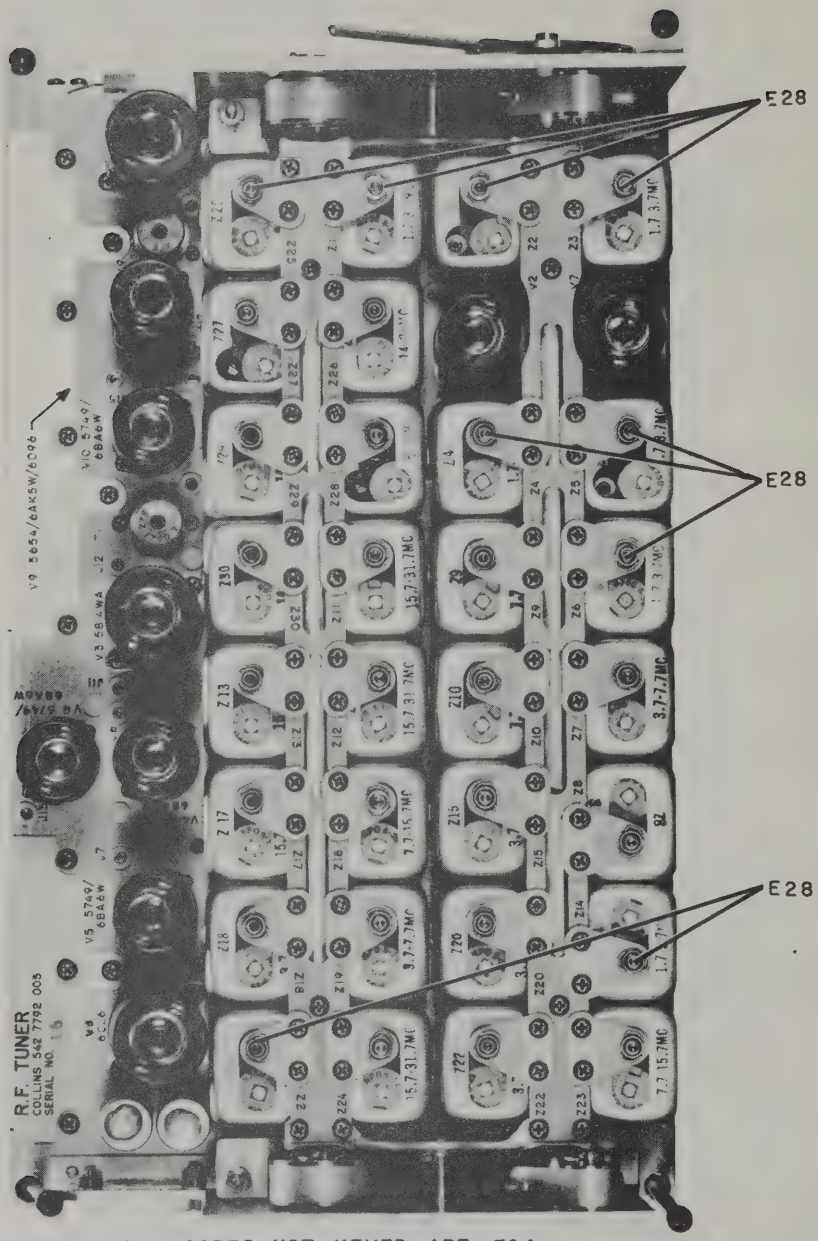


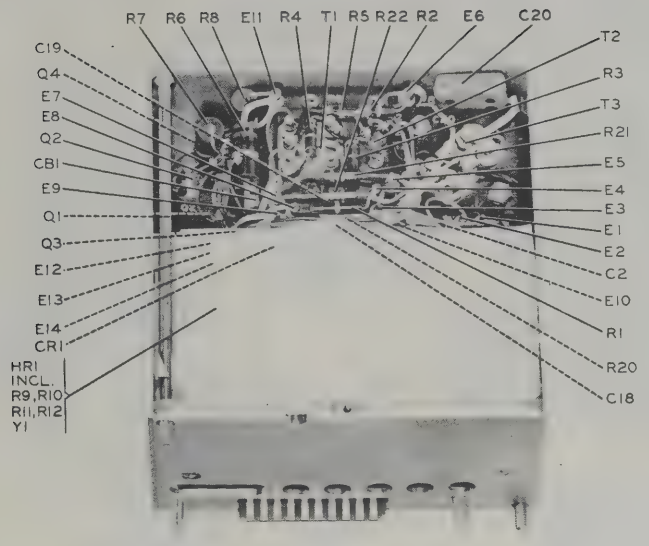
Figure 4-5. R-F Tuner Module, Front View



NOTE: 1. ALL CORES NOT KEYED ARE E24

2. ALL OTHER KEYED COMPONENTS ARE THE SAME AS THAT SHOWN IN FIGURE 4-5.

Figure 4-6. R-F Tuner Module, Model B, Front View



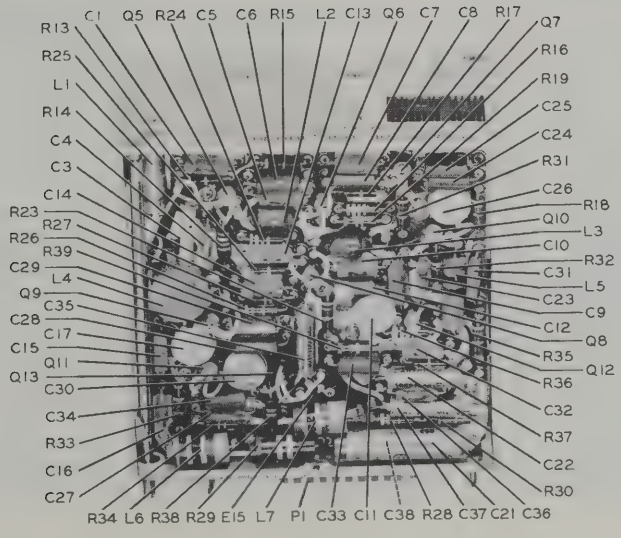


Figure 4-7. Reference Oscillator Module

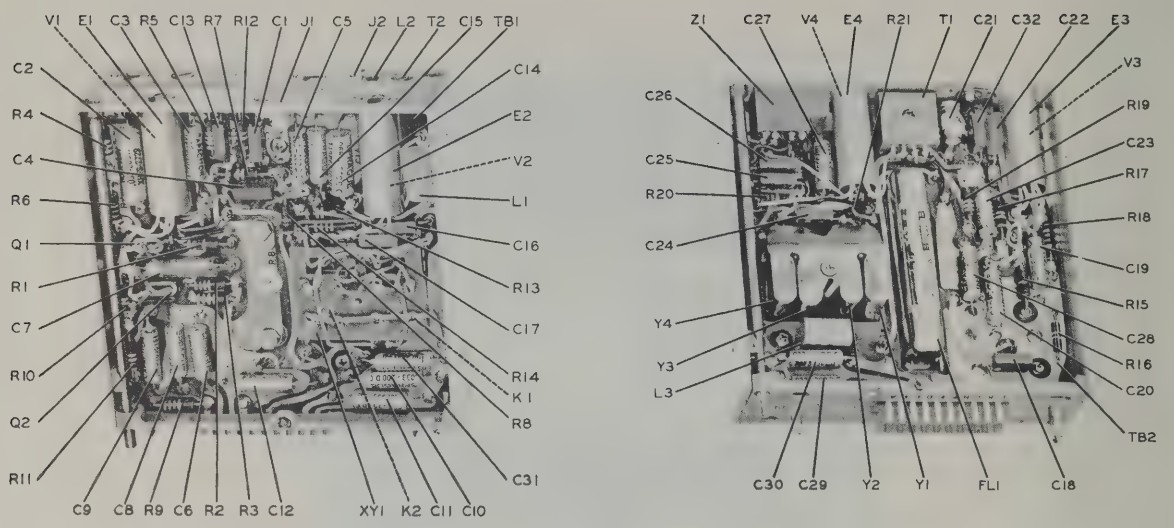


Figure 4-8. Sidestep Oscillator Module

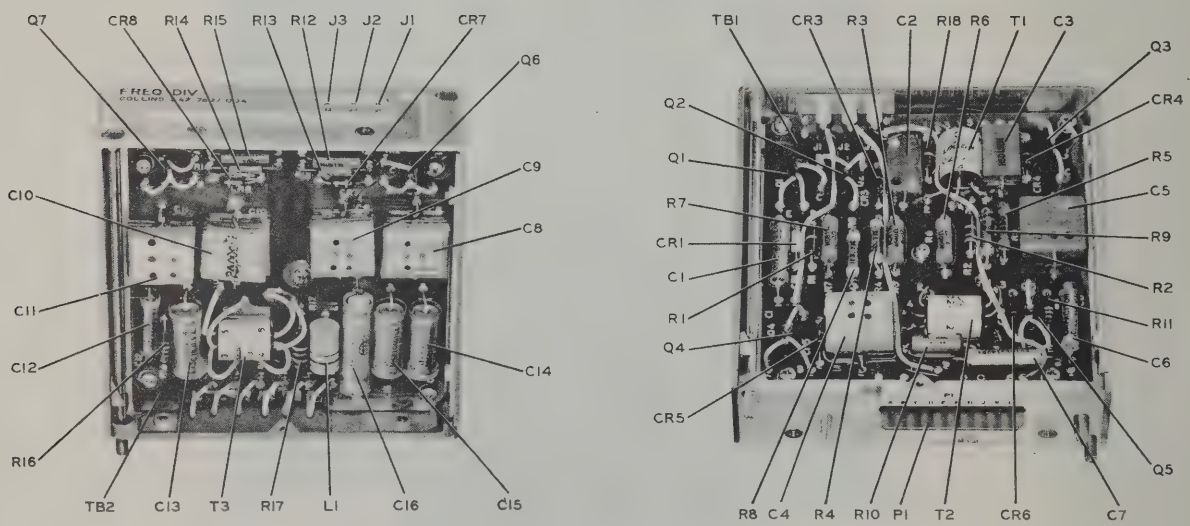


Figure 4-9. Frequency Divider Module

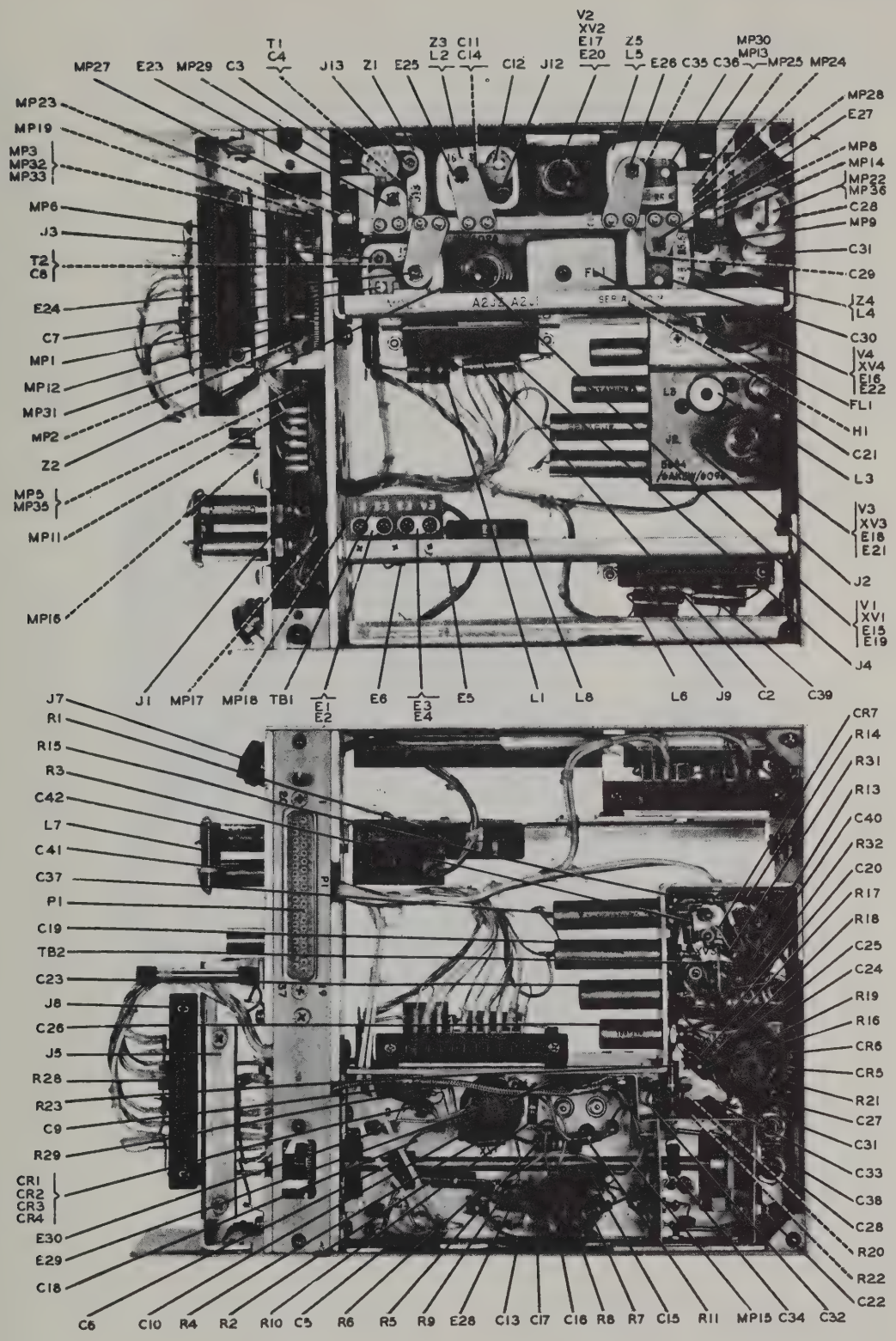


Figure 4-10. Stabilized Master Oscillator, Model A, Master Oscillator Assembly

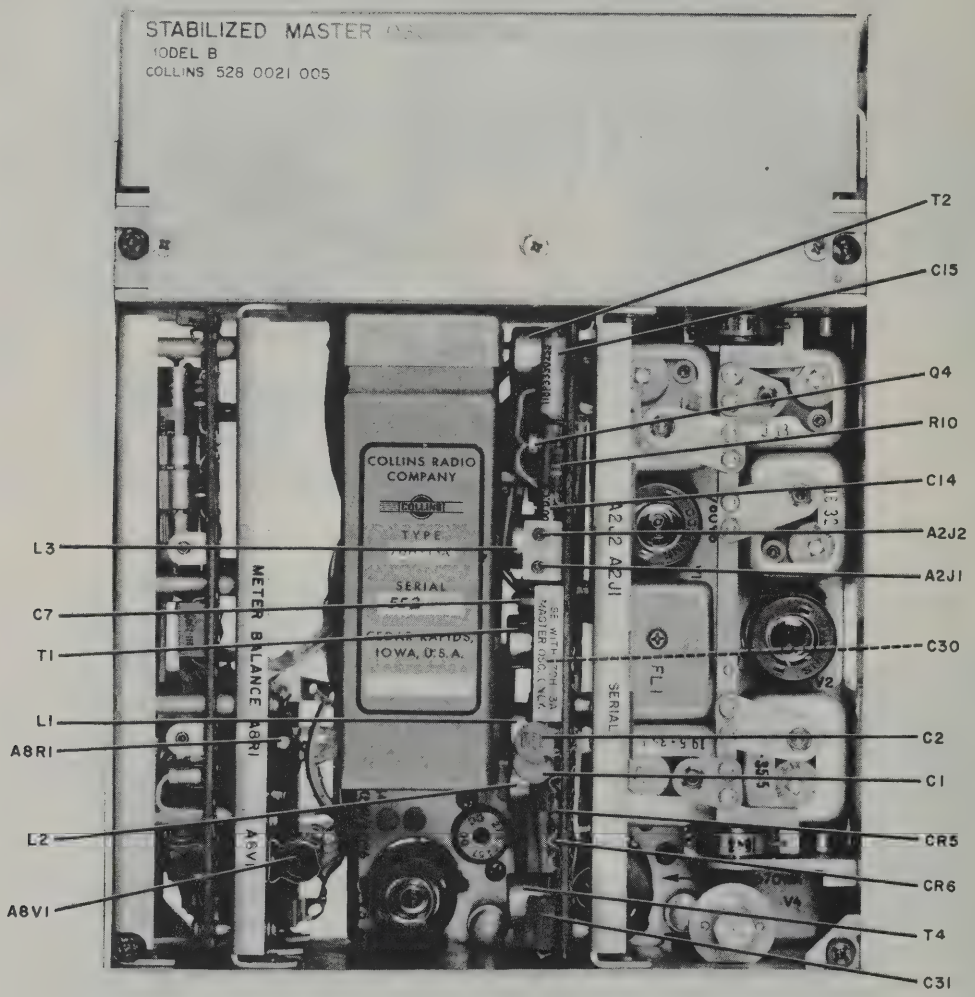


Figure 4-11. Stabilized Master Oscillator Module, Model B

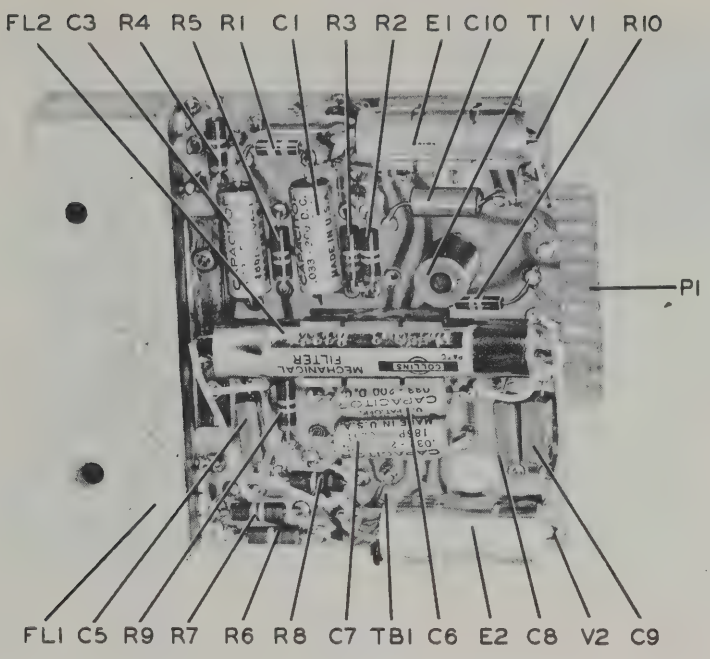


Figure 4-12. Stabilized Master Oscillator Module, I-F Mixer Assembly

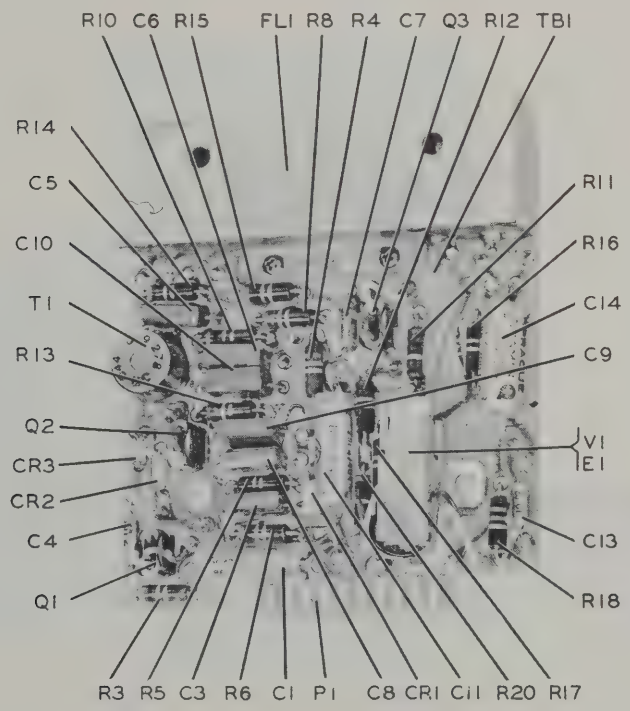


Figure 4-13. Stabilized Master Oscillator Module, 4-Kc Spectrum Generator Assembly

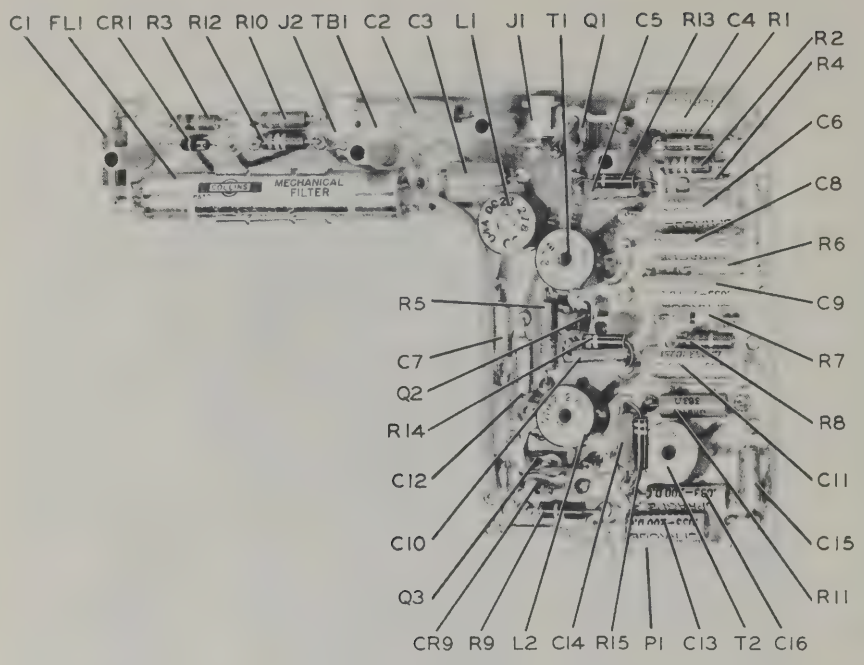


Figure 4-14. Stabilized Master Oscillator Module, Reference I-F Amplifier

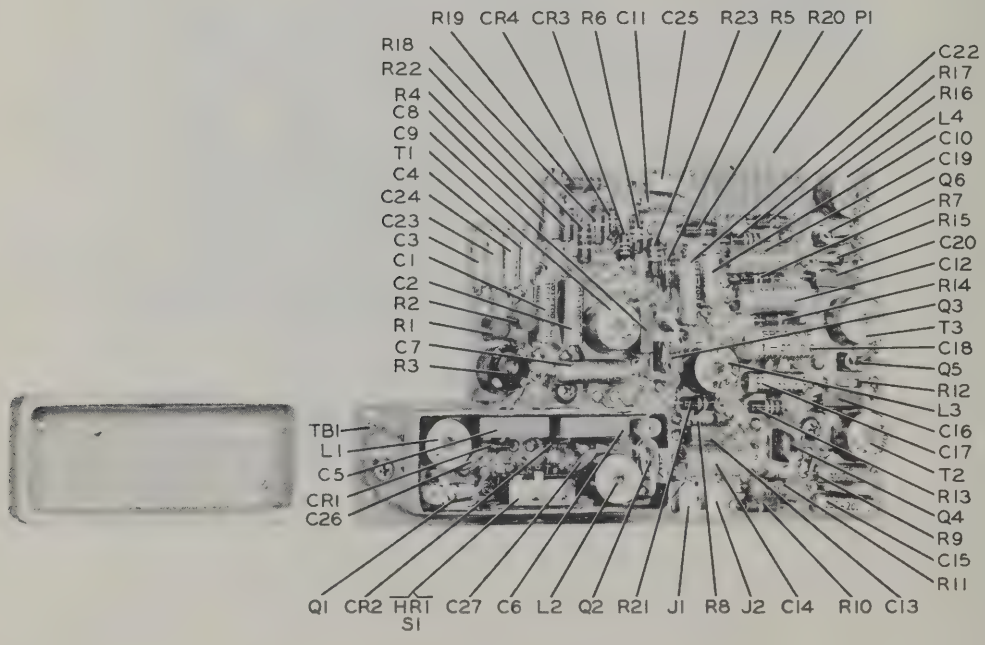


Figure 4-15. Stabilized Master Oscillator Module, Signal I-F Amplifier

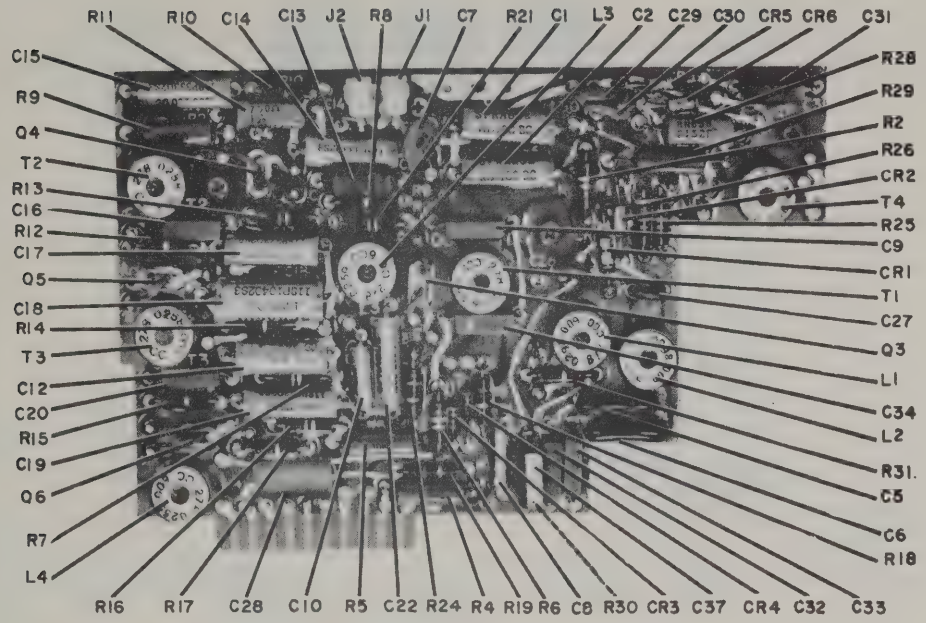


Figure 4-16. Stabilized Master Oscillator Model B, I-F Amplifier Board

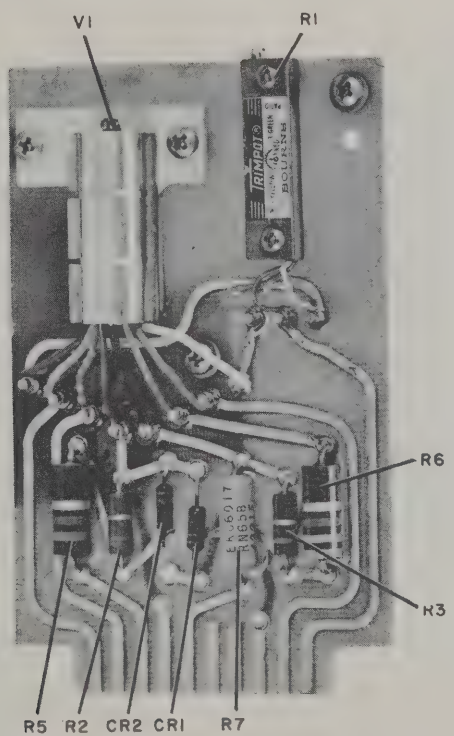


Figure 4-17. Stabilized Master Oscillator
Model B and C, Meter Amplifier Board

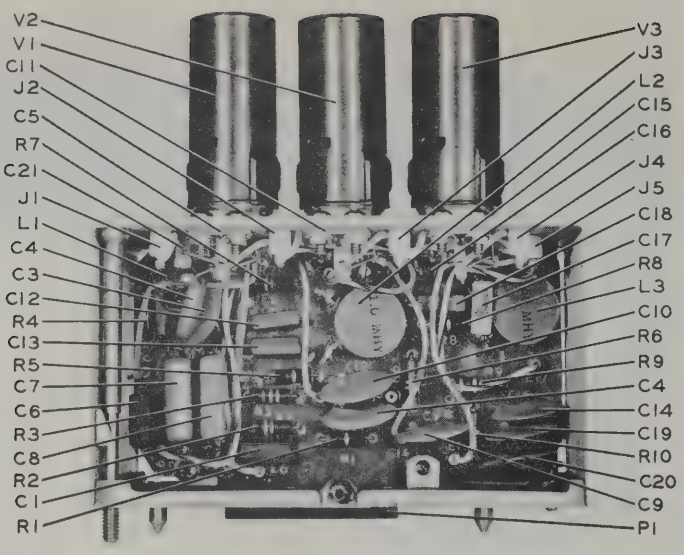


Figure 4-18. Isolation Amplifier Module

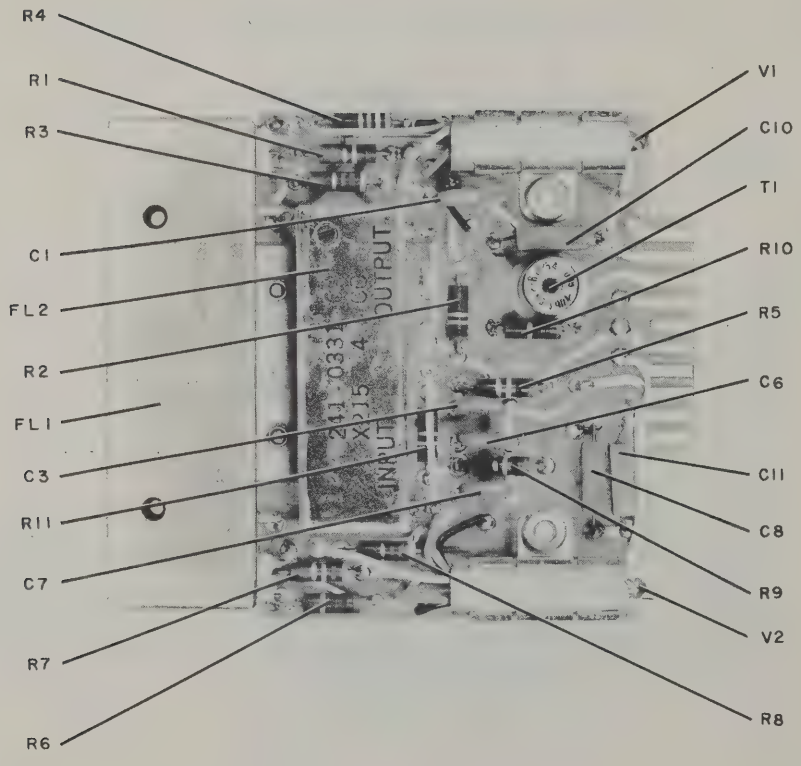


Figure 4-19. Stabilized Master Oscillator Module,
Model C, I-F Mixer Assembly

SECTION V
ILLUSTRATIONS

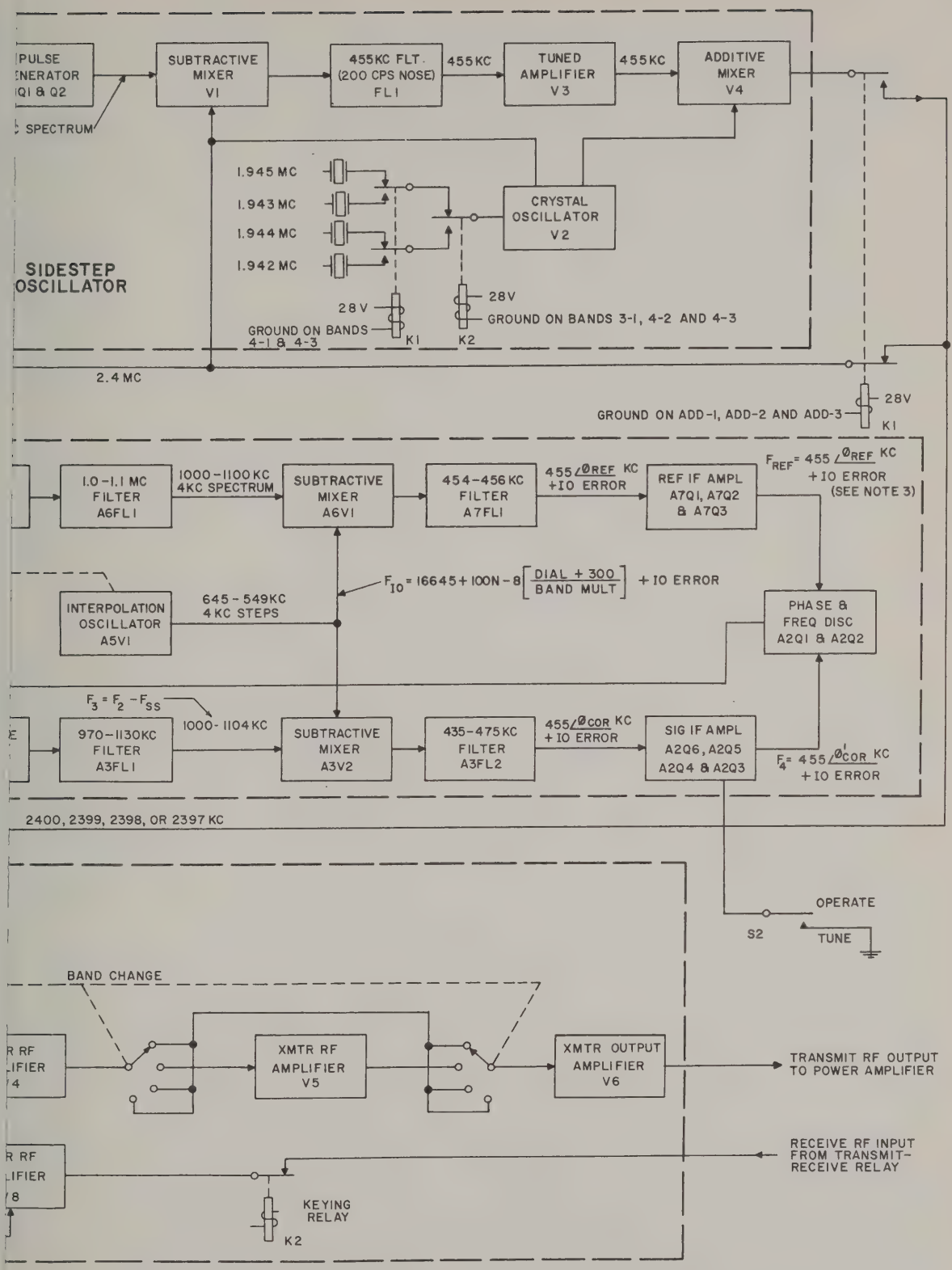


Figure 5-1. Frequency Generator 786E-1, Block Diagram

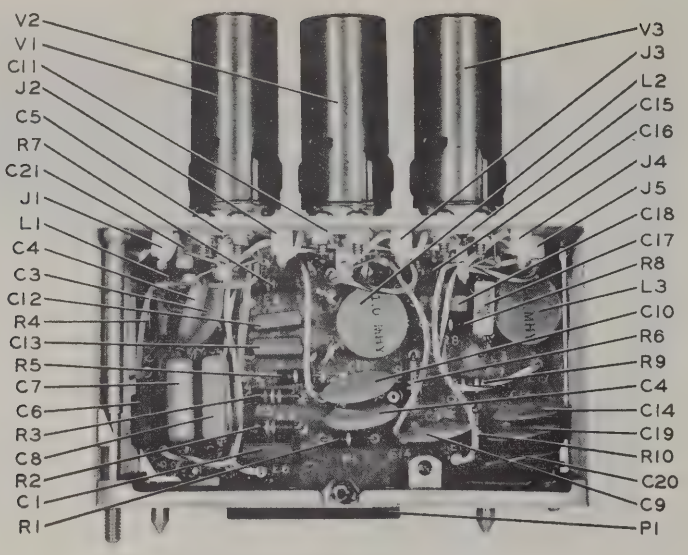


Figure 4-18. Isolation Amplifier Module

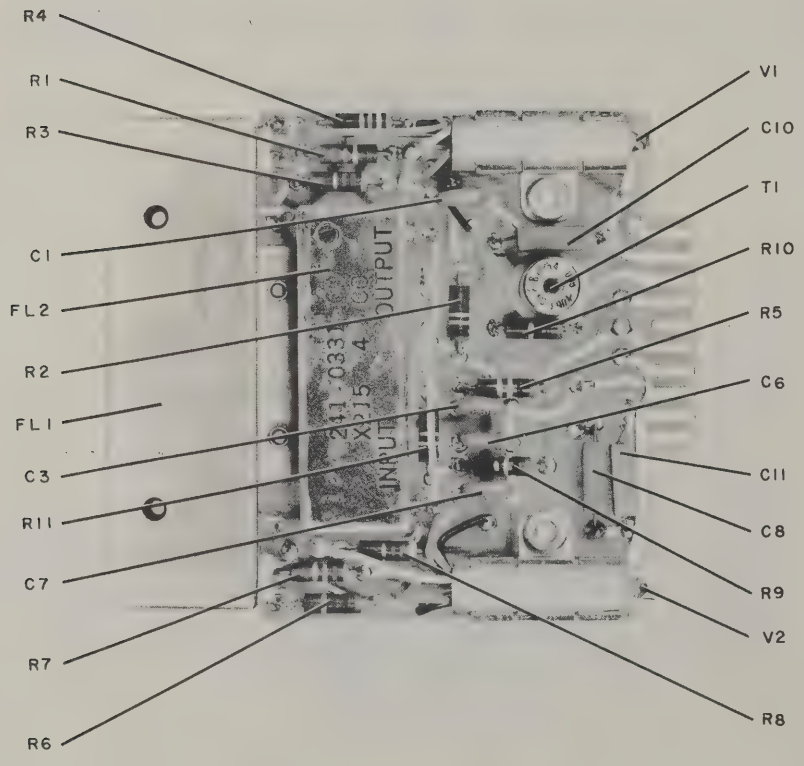
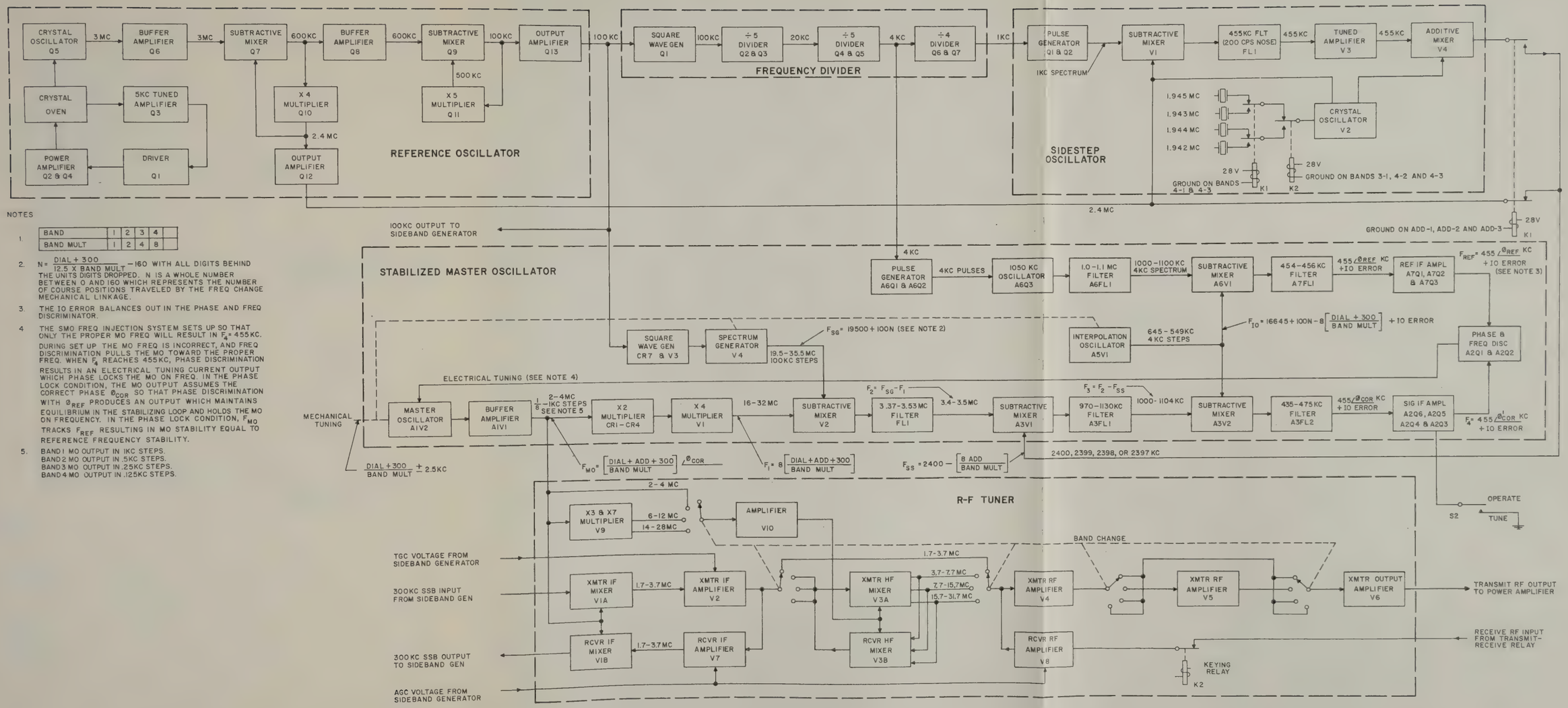


Figure 4-19. Stabilized Master Oscillator Module,
Model C, I-F Mixer Assembly



NOTES

1.

BAND	1	2	3	4	
BAND MULT	1	2	4	8	

2. $N = \frac{\text{DIAL} + 300}{12.5 \times \text{BAND MULT}} - 160$ WITH ALL DIGITS BEHIND THE UNITS DIGITS DROPPED. N IS A WHOLE NUMBER BETWEEN 0 AND 160 WHICH REPRESENTS THE NUMBER OF COURSE POSITIONS TRAVELED BY THE FREQ CHANGE MECHANICAL LINKAGE.
3. THE IO ERROR BALANCES OUT IN THE PHASE AND FREQ DISCRIMINATOR.
4. THE SMO FREQ INJECTION SYSTEM SETS UP SO THAT ONLY THE PROPER MO FREQ WILL RESULT IN $F_4 = 455$KC. DURING SET UP THE MO FREQ IS INCORRECT, AND FREQ DISCRIMINATION PULLS THE MO TOWARD THE PROPER FREQ. WHEN F_4 REACHES 455KC, PHASE DISCRIMINATION RESULTS IN AN ELECTRICAL TUNING CURRENT OUTPUT WHICH PHASE LOCKS THE MO ON FREQ. IN THE PHASE LOCK CONDITION, THE MO OUTPUT ASSUMES THE CORRECT PHASE $\emptyset_{COR}$ SO THAT PHASE DISCRIMINATION WITH $\emptyset_{REF}$ PRODUCES AN OUTPUT WHICH MAINTAINS EQUILIBRIUM IN THE STABILIZING LOOP AND HOLDS THE MO ON FREQUENCY. IN THE PHASE LOCK CONDITION, F_{MO} TRACKS F_{REF} RESULTING IN MO STABILITY EQUAL TO REFERENCE FREQUENCY STABILITY.
5. BAND 1 MO OUTPUT IN 1KC STEPS.
   BAND 2 MO OUTPUT IN .5KC STEPS.
   BAND 3 MO OUTPUT IN .25KC STEPS.
   BAND 4 MO OUTPUT IN .125KC STEPS.

Figure 5-1. Frequency Generator 786E-1, Block Diagram

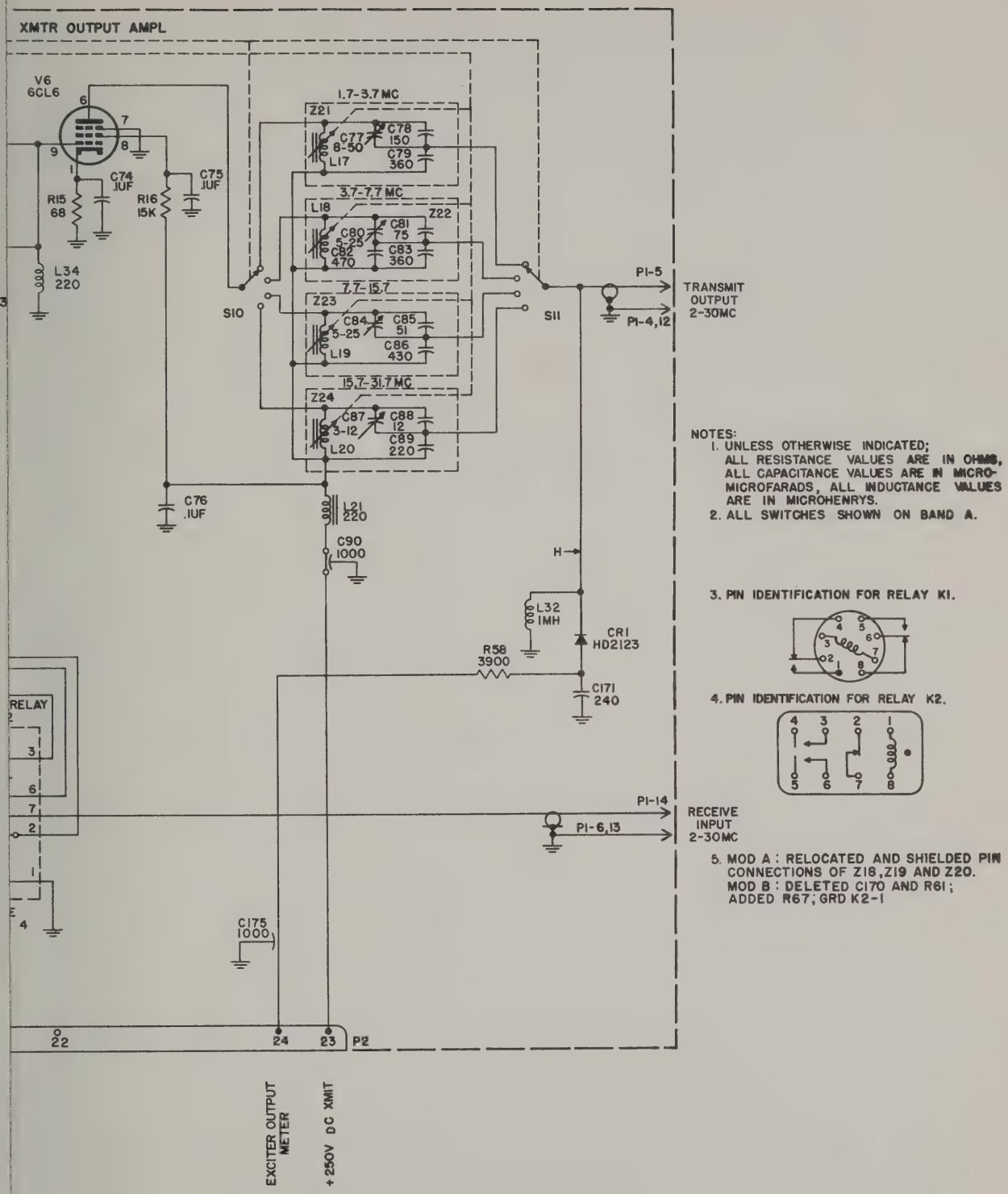
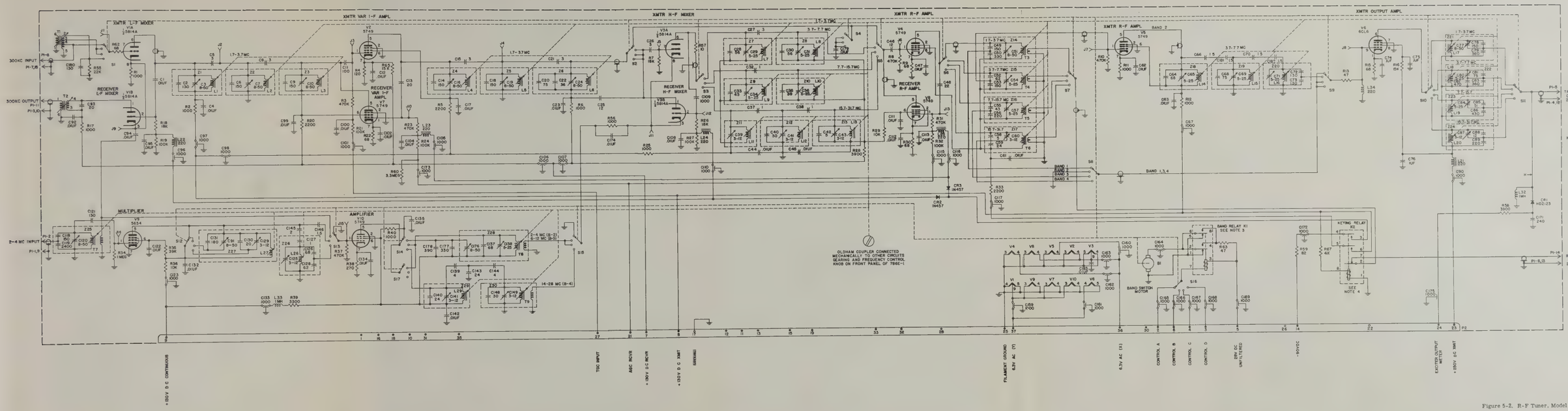


Figure 5-2. R-F Tuner, Model A, Schematic Diagram



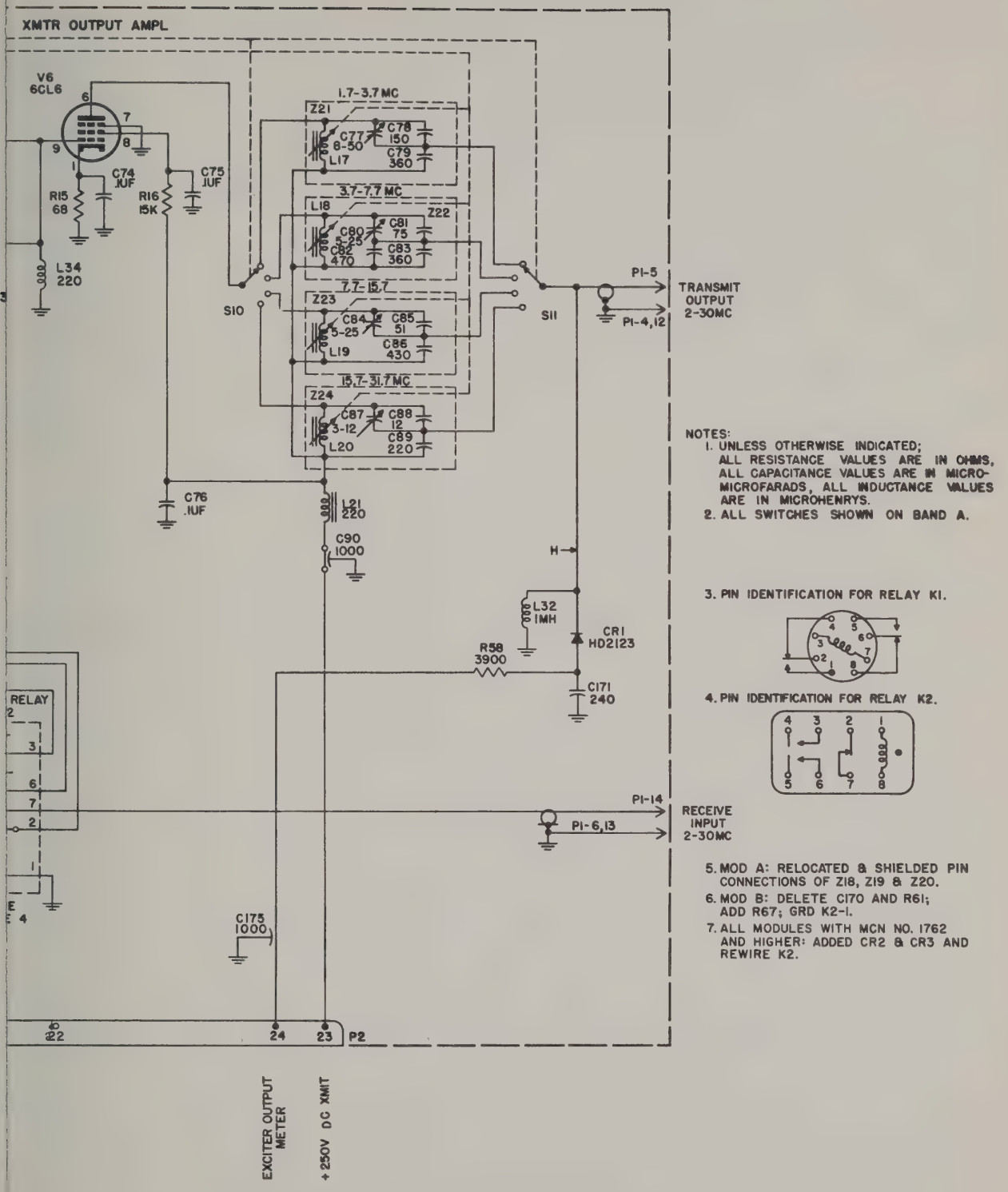
NOTES:
1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICRO-MICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS
2. ALL SWITCHES SHOWN ON BAND A

3. PIN IDENTIFICATION FOR RELAY K1

4 PIN IDENTIFICATION FOR RELAY K2

5 MOD A: RELOCATED AND SHIELDED PIN CONNECTIONS OF Z16,Z19 AND Z20
MOD B: DELETED C170 AND R61.
ADDED R67, GRD K2-1

Figure 5-2. R-F Tuner, Model A, Schematic Diagram



NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICRO-MICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. ALL SWITCHES SHOWN ON BAND A.
3. PIN IDENTIFICATION FOR RELAY K1.

4. PIN IDENTIFICATION FOR RELAY K2.

5. MOD A: RELOCATED & SHIELDED PIN CONNECTIONS OF Z18, Z19 & Z20.
6. MOD B: DELETE C170 AND R61; ADD R67; GRD K2-1.
7. ALL MODULES WITH MCN NO. 1762 AND HIGHER: ADDED CR2 & CR3 AND REWIRE K2.

Figure 5-3. R-F Tuner Model B, Schematic Diagram

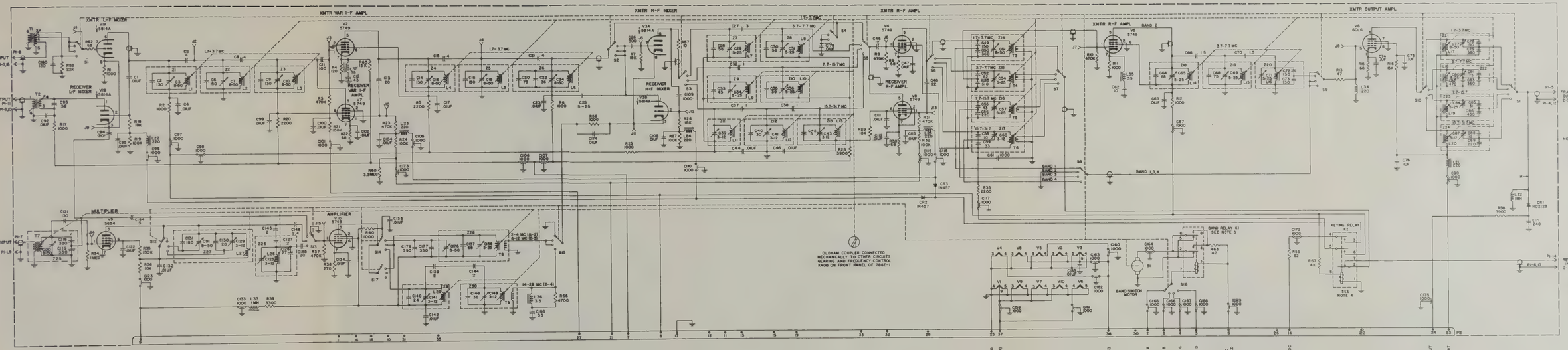
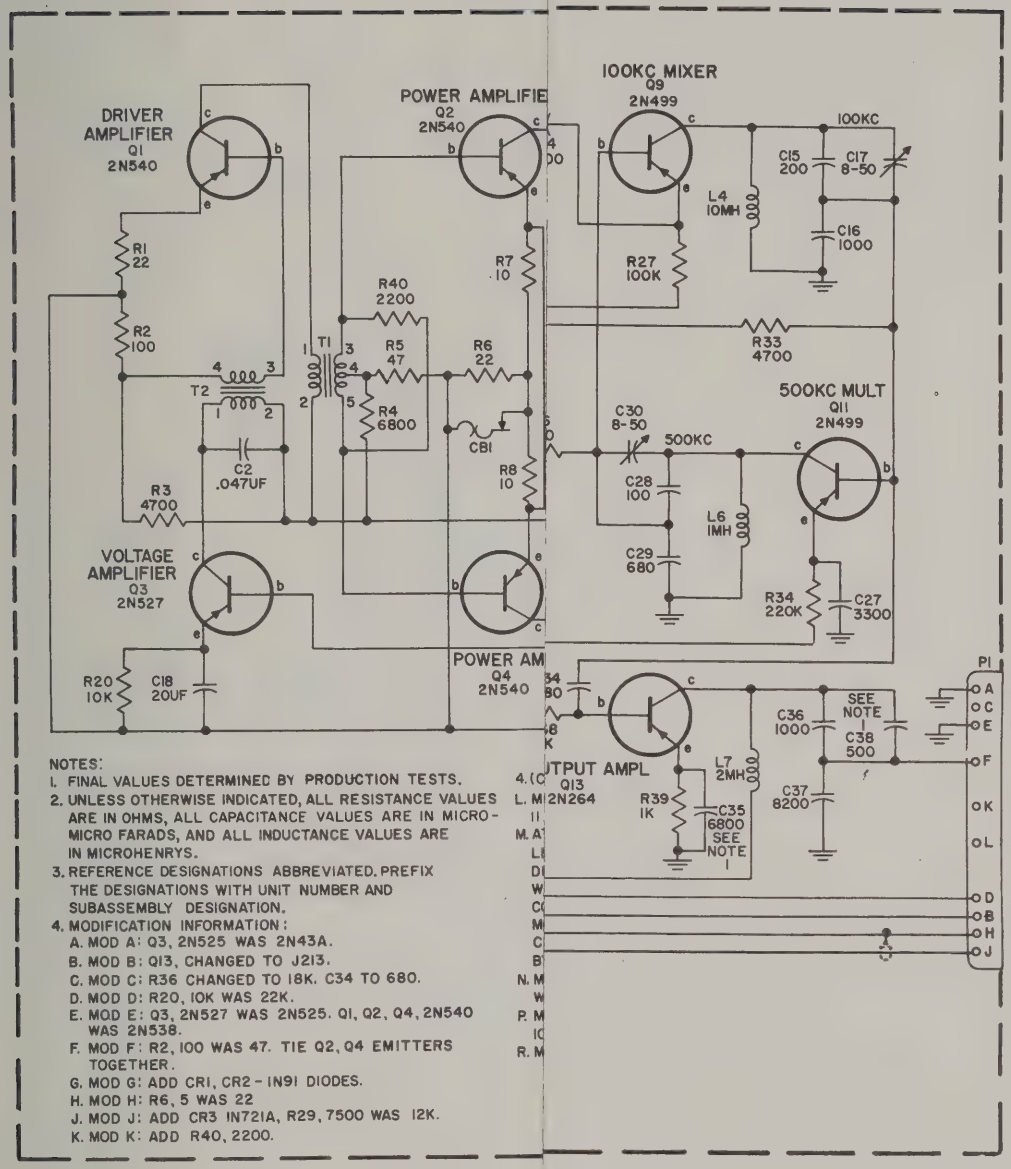
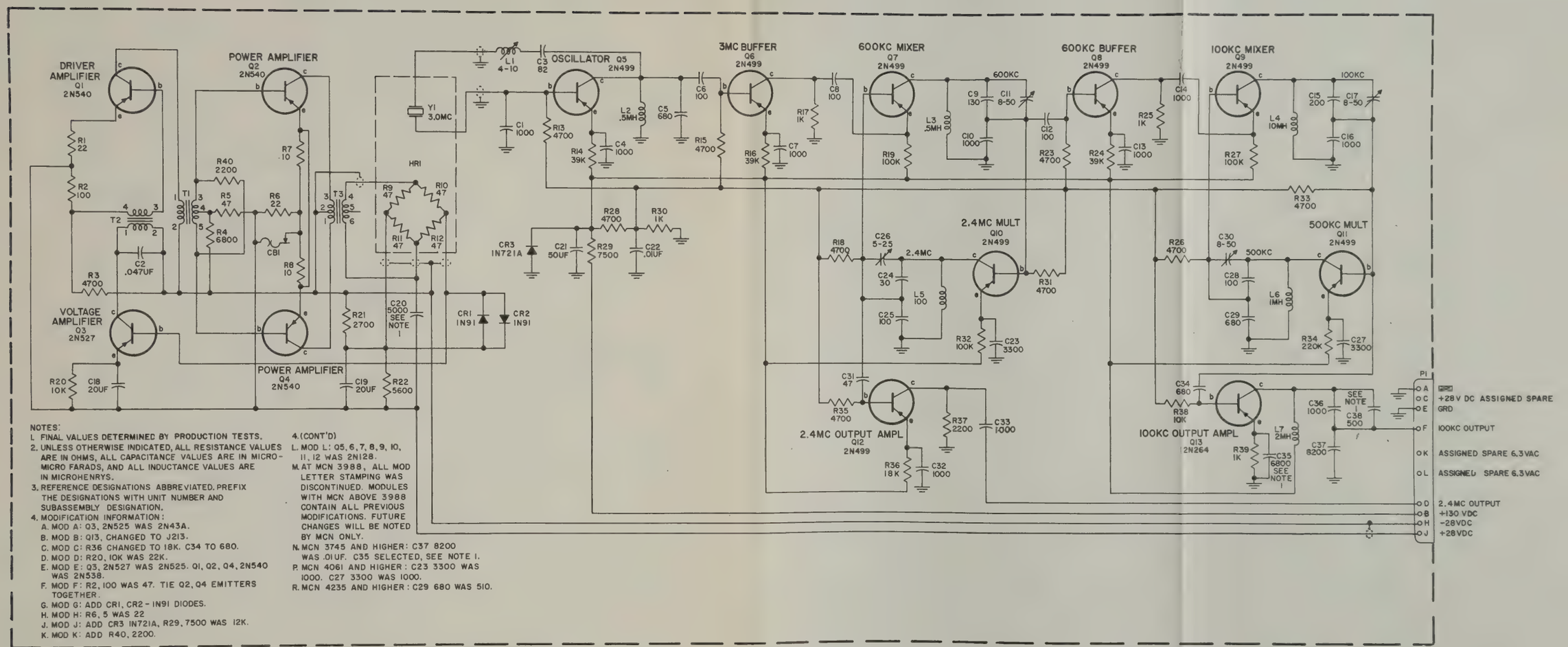

XMTR L-F MIXER
XMTR VAR I-F AMPL
XMTR H-F MIXER
XMTR R-F AMPL
XMTR R-F AMPL BAND 2
XMTR OUTPUT AMPL
RECEIVER L-F MIXER
RECEIVER VAR I-F AMPL
RECEIVER H-F MIXER
RECEIVER R-F AMPL
MULTIPLIER
AMPLIFIER
KEYING RELAY K2
BAND RELAY K1 SEE NOTE 3
BAND SWITCH MOTOR
300KC INPUT
300KC OUTPUT
2-4 MC INPUT
TRANSMIT OUTPUT 2-30MC
RECEIVE INPUT 2-30MC
OLDHAM COUPLER CONNECTED MECHANICALLY TO OTHER CIRCUITS GEARING AND FREQUENCY CONTROL KNOB ON FRONT PANEL OF 786E-1
BAND 1,3,4
BAND 2
BAND 3
BAND 4
NOTES:
1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICRO-MICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS
2. ALL SWITCHES SHOWN ON BAND A
3. PIN IDENTIFICATION FOR RELAY K1
4 PIN IDENTIFICATION FOR RELAY K2
5. MOD A: RELOCATED & SHIELDED PIN CONNECTIONS OF Z18, Z19 & Z20.
6. MOD B: DELETE C170 AND R61; ADD R67, GRD K2-L
7. ALL MODULES WITH MCN NO. 1762 AND HIGHER: ADDED CR3 & CR3 AND REWIRE K2.
CONTINUOUS + 150 V
TRC XMIT
AGC REC
+150 V REC
+150 V XMIT
GROUND
FILAMENT GROUND
6.3V AC (1)
6.3V AC (2)
CONTROL A
CONTROL B
CONTROL C
CONTROL D
-150V
-300V AC UNFILTERED
-300V
EXCITER OUTPUT METER
+150V DC XMIT

Figure 5-3. R-F Tuner Model B, Schematic Diagram



NOTES:
1. FINAL VALUES DETERMINED BY PRODUCTION TESTS.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICRO-MICRO FARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
3. REFERENCE DESIGNATIONS ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
4. MODIFICATION INFORMATION:
   A. MOD A: Q3, 2N525 WAS 2N43A.
   B. MOD B: Q13, CHANGED TO J213.
   C. MOD C: R36 CHANGED TO 18K. C34 TO 680.
   D. MOD D: R20, 10K WAS 22K.
   E. MOD E: Q3, 2N527 WAS 2N525. Q1, Q2, Q4, 2N540 WAS 2N538.
   F. MOD F: R2, 100 WAS 47. TIE Q2, Q4 EMITTERS TOGETHER.
   G. MOD G: ADD CR1, CR2 - IN91 DIODES.
   H. MOD H: R6, 5 WAS 22
   J. MOD J: ADD CR3 IN721A, R29, 7500 WAS 12K.
   K. MOD K: ADD R40, 2200.

nce Oscillator Module, Schematic Diagram



NOTES:
1. FINAL VALUES DETERMINED BY PRODUCTION TESTS.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICRO-MICRO FARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
3. REFERENCE DESIGNATIONS ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
4. MODIFICATION INFORMATION:
   A. MOD A: Q3, 2N525 WAS 2N43A.
   B. MOD B: Q13, CHANGED TO J213.
   C. MOD C: R36 CHANGED TO 18K. C34 TO 680.
   D. MOD D: R20, 10K WAS 22K.
   E. MOD E: Q3, 2N527 WAS 2N525. Q1, Q2, Q4, 2N540 WAS 2N538.
   F. MOD F: R2, 100 WAS 47. TIE Q2, Q4 EMITTERS TOGETHER.
   G. MOD G: ADD CR1, CR2 - IN91 DIODES.
   H. MOD H: R6, 5 WAS 22
   J. MOD J: ADD CR3 IN721A, R29, 7500 WAS 12K.
   K. MOD K: ADD R40, 2200.
4. (CONT'D)
   L. MOD L: Q5, 6, 7, 8, 9, 10, 11, 12 WAS 2N128.
   M. AT MCN 3988, ALL MOD LETTER STAMPING WAS DISCONTINUED. MODULES WITH MCN ABOVE 3988 CONTAIN ALL PREVIOUS MODIFICATIONS. FUTURE CHANGES WILL BE NOTED BY MCN ONLY.
   N. MCN 3745 AND HIGHER: C37 8200 WAS .01UF. C35 SELECTED, SEE NOTE 1.
   P. MCN 4061 AND HIGHER: C23 3300 WAS 1000. C27 3300 WAS 1000.
   R. MCN 4235 AND HIGHER: C29 680 WAS 510.

Figure 5-4. Reference Oscillator Module, Schematic Diagram

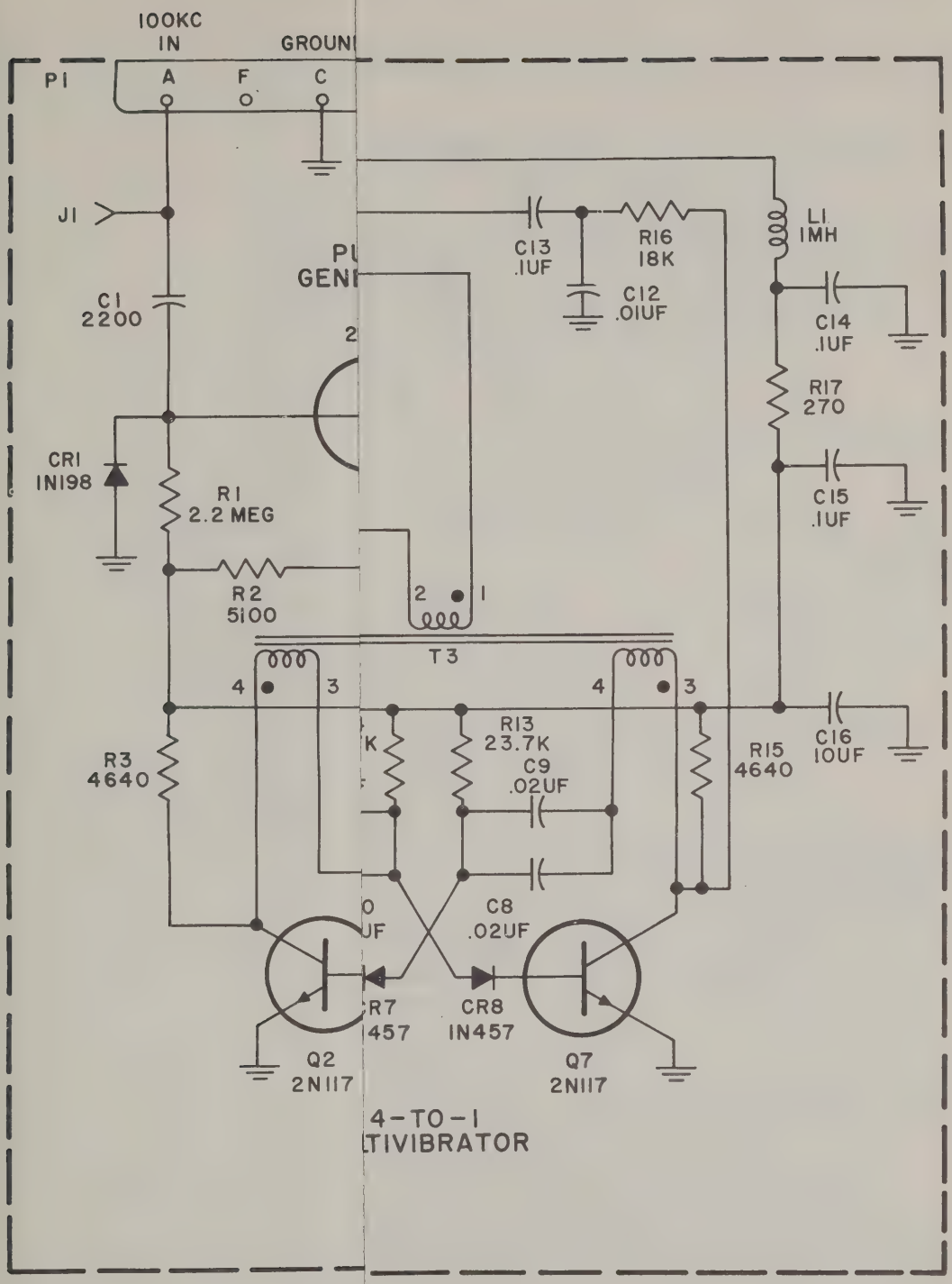


Figure 5-5. Frequency Divider Module, Schematic Diagram

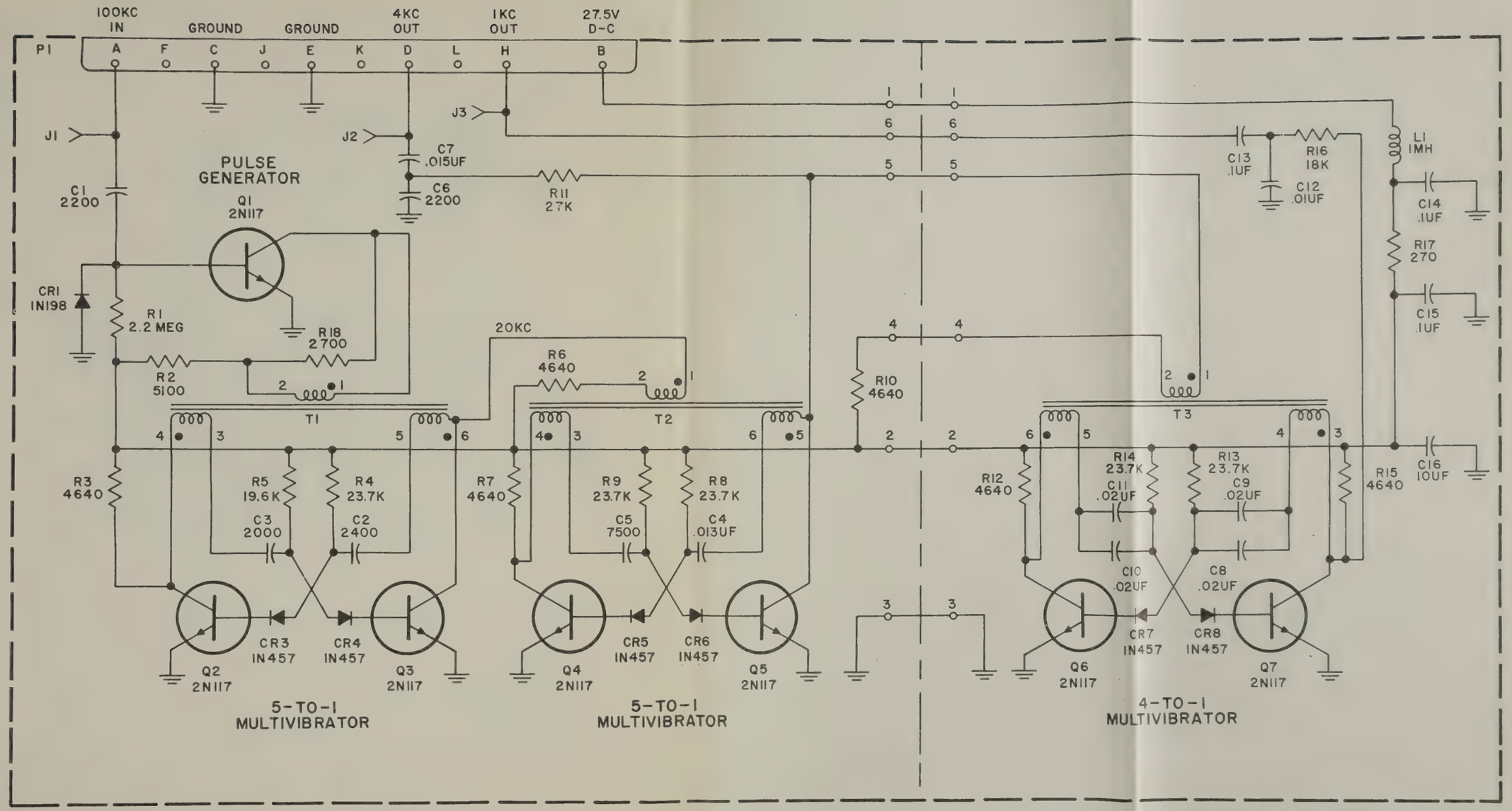
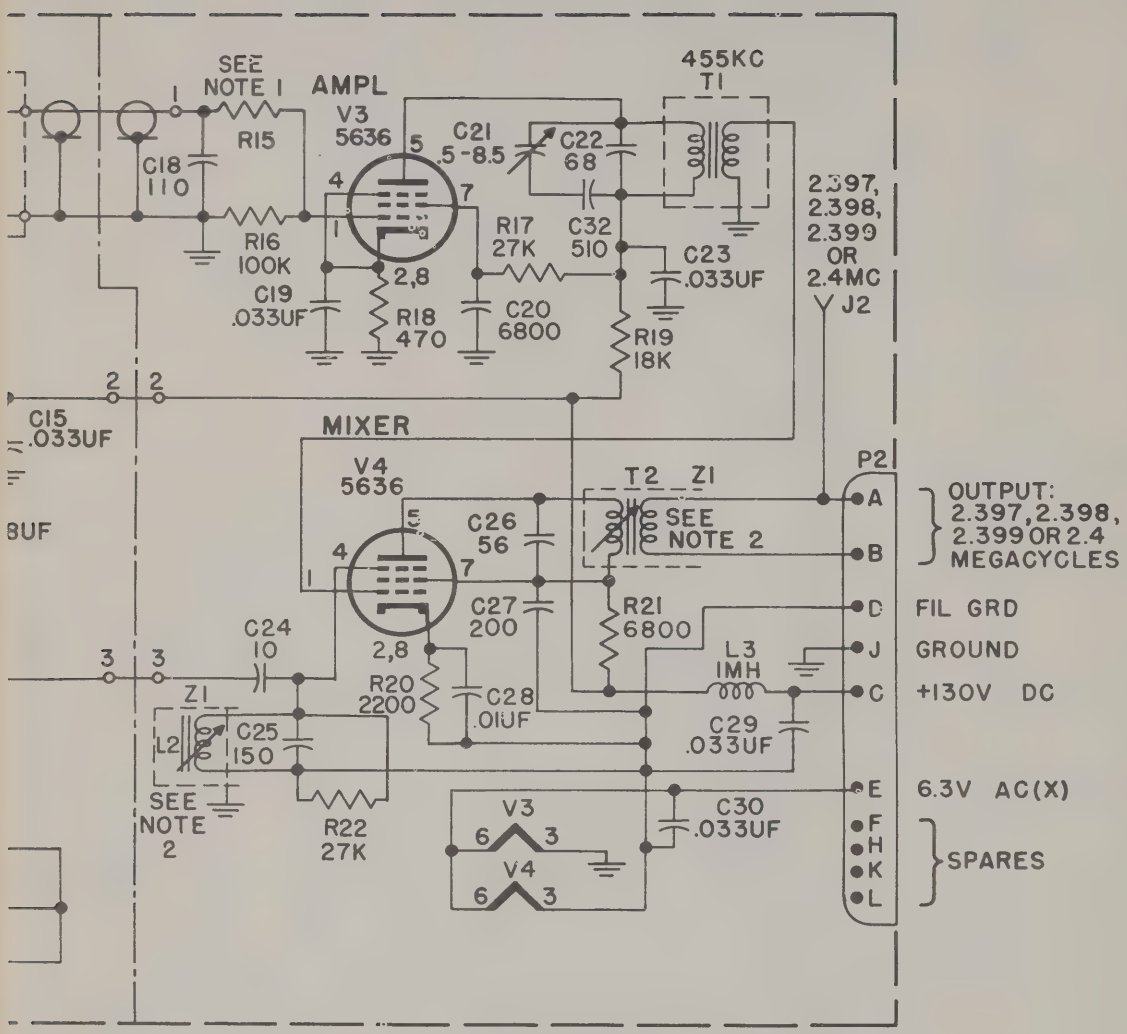


Figure 5-5. Frequency Divider Module, Schematic Diagram



5. MOD A: DOES NOT APPLY.
   MOD B: C1, 33 WAS 10.
   C7, .033UF WAS .01 UF.
   C9, 6800 WAS .01UF.
   R2, 33K, WAS 68K.
   MOD C: R22, 27K ADDED.
   MOD D: C27, 200 UUF WAS .033UF

NOTES:

1. UNLESS OTHER
VALUES ARE I
UUF, AND ALL
2. FINAL VALUE D
3. FLI, A3FLI, AND
COMPONENTS S
4. DC RESISTANCE
OHM HAS BEEN
5. FOR DESTINATI
SEE FREQUENC
SCHEMATIC DIA
6. REFERENCE DE
PREFIX THE DE
SUBASSEMBLY

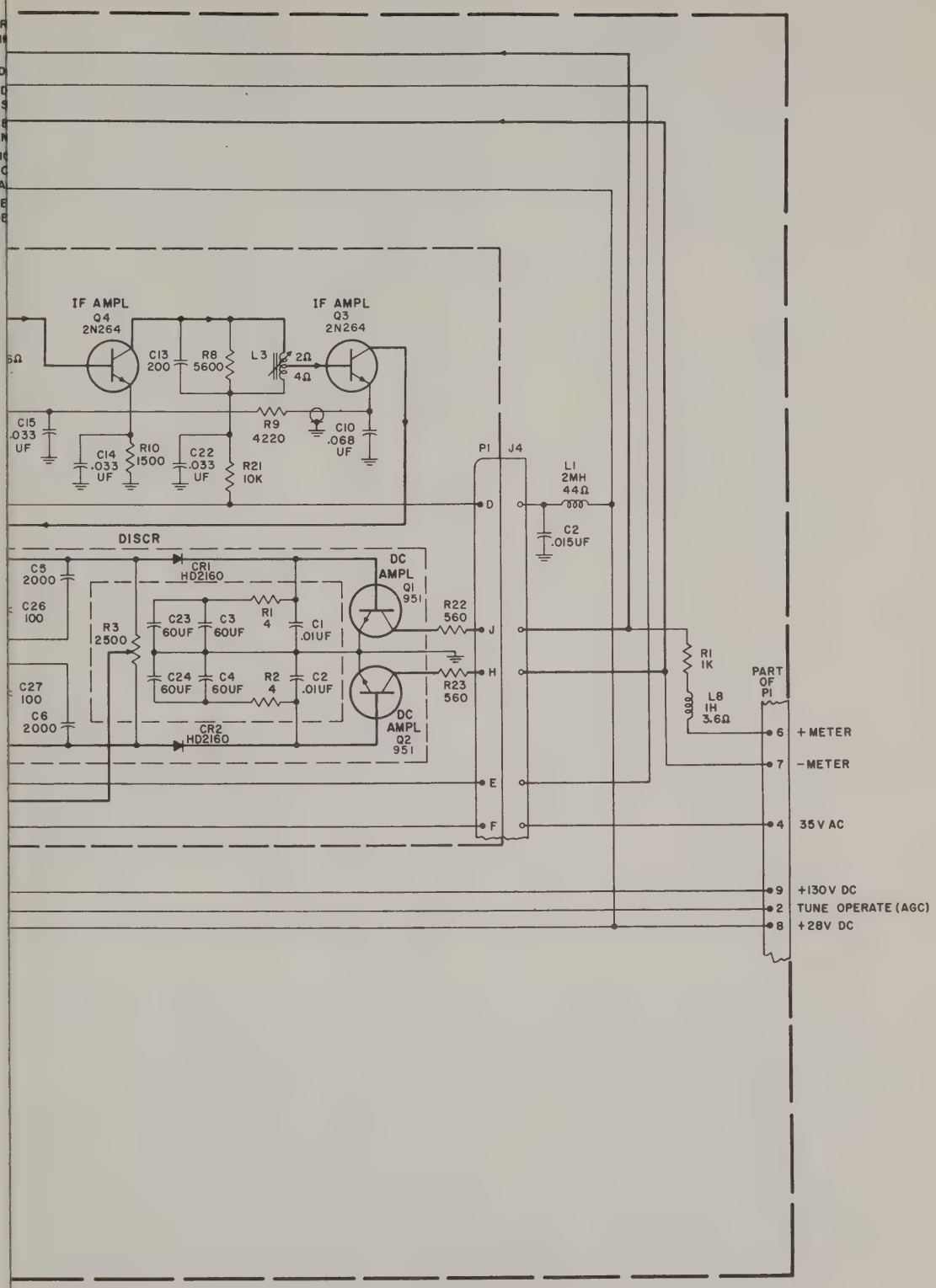
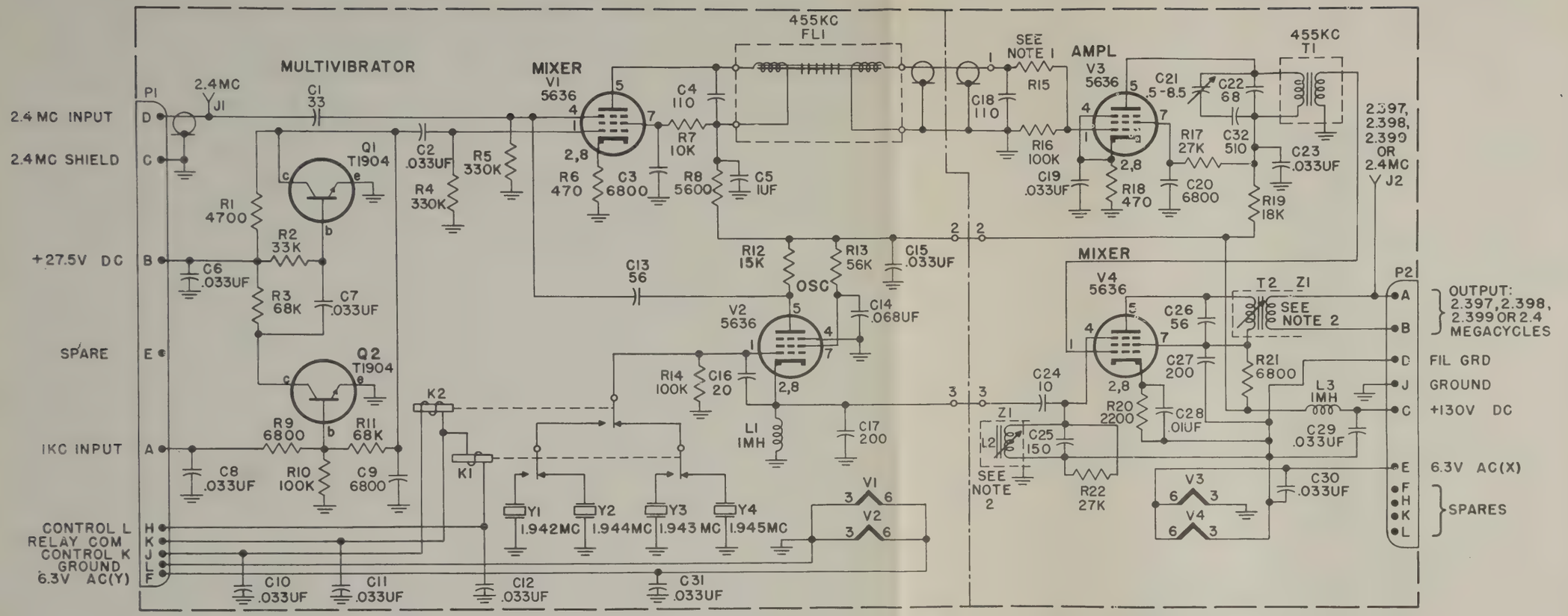


Figure 5-7. Stabilized Master Oscillator, Model A, Schematic Diagram



NOTES:

1. FINAL VALUE DETERMINED BY PRODUCTION TEST. NOMINAL VALUE: 39K.
2. T2 AND L2 ARE TOROIDS SEPARATED BY A GROUNDED COPPER SHIELD AND ENCLOSED IN ONE POTTED ASSEMBLY, Z1.
3. UNLESS OTHERWISE INDICATED:
   ALL RESISTANCE VALUES ARE IN OHMS,
   ALL CAPACITANCE VALUES ARE IN UUF
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.
5. MOD A: DOES NOT APPLY.
   MOD B: C1, 33 WAS 10.
   C7, .033UF WAS .01 UF.
   C9, 6800 WAS .01UF.
   R2, 33K, WAS 68K.
   MOD C: R22, 27K ADDED.
   MOD D: C27, 200 UUF WAS .033UF

Figure 5-6. Sidestep Oscillator Module, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN MICROHENRYS.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS.
3. FLI, ARFLI, AND ARFLI ARE NON-REPAIRABLE ITEMS, COMPONENTS SHOWN ARE REPRESENTATIVE ONLY.
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM
6. REFERENCE DESIGNATIONS ARE ABBREVIATED; PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATIONS

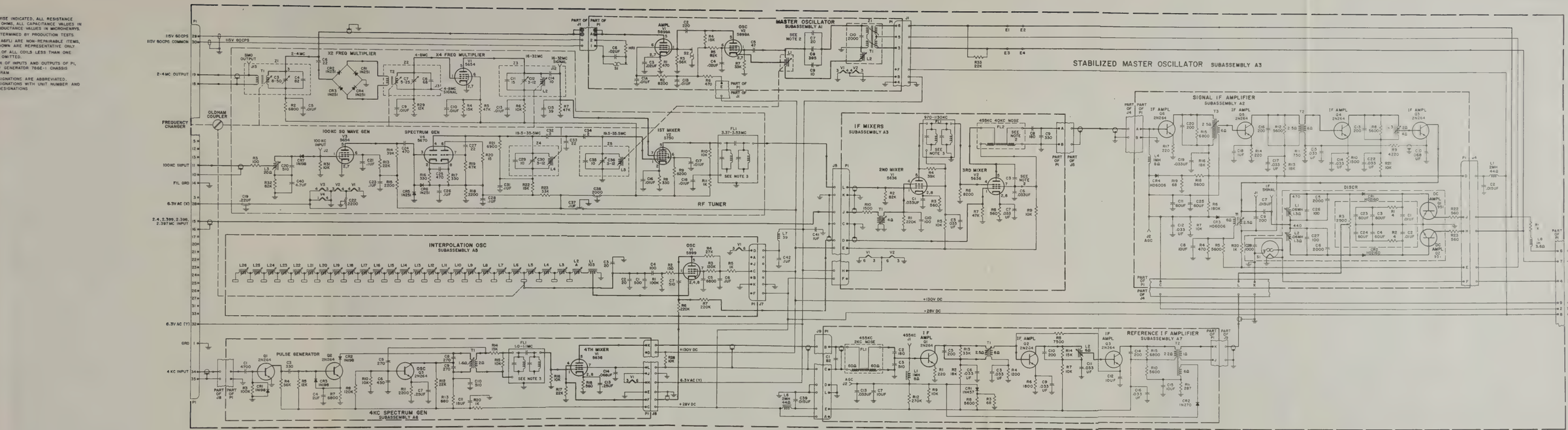


Figure 5-7. Stabilized Master Oscillator, Model A, Schematic Diagram

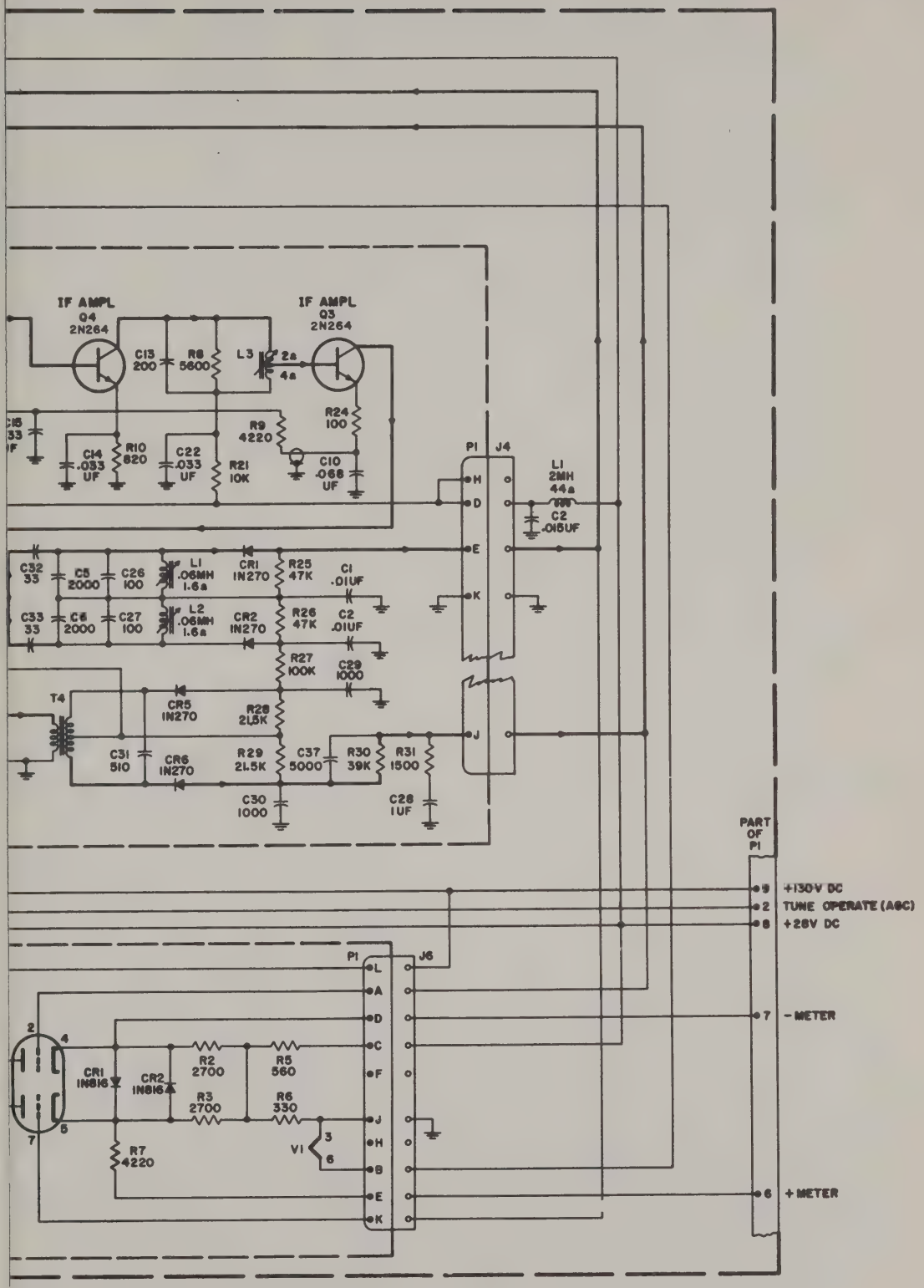


Figure 5-8. Stabilized Master Oscillator, Model B, Schematic Diagram

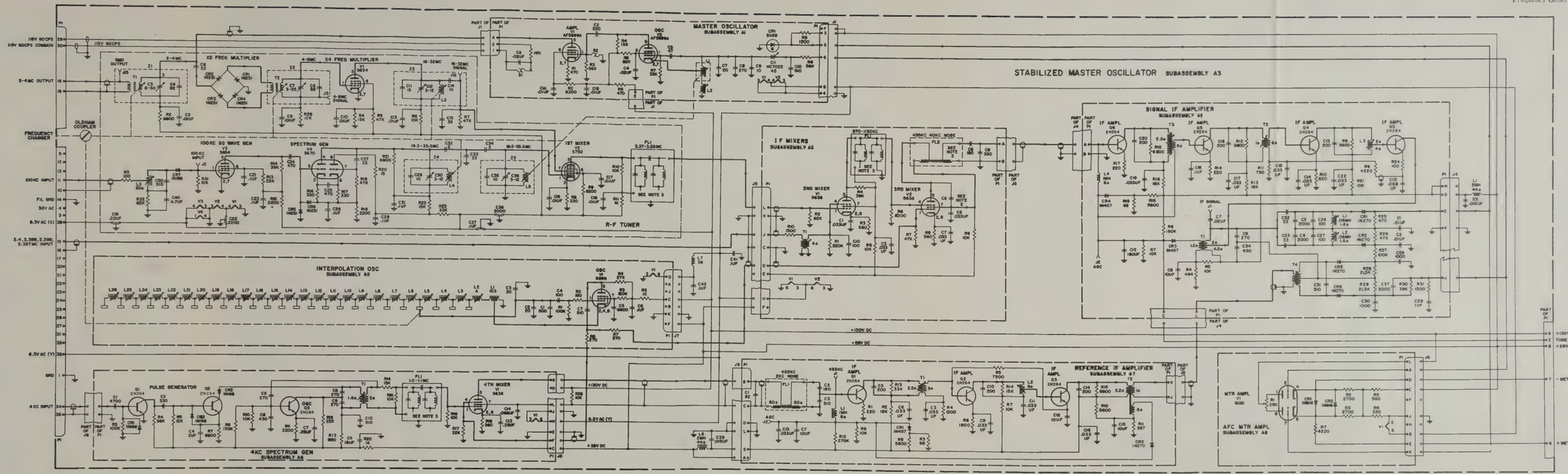


Figure 5-8. Stabilized Master Oscillator, Model B, Schematic Diagram

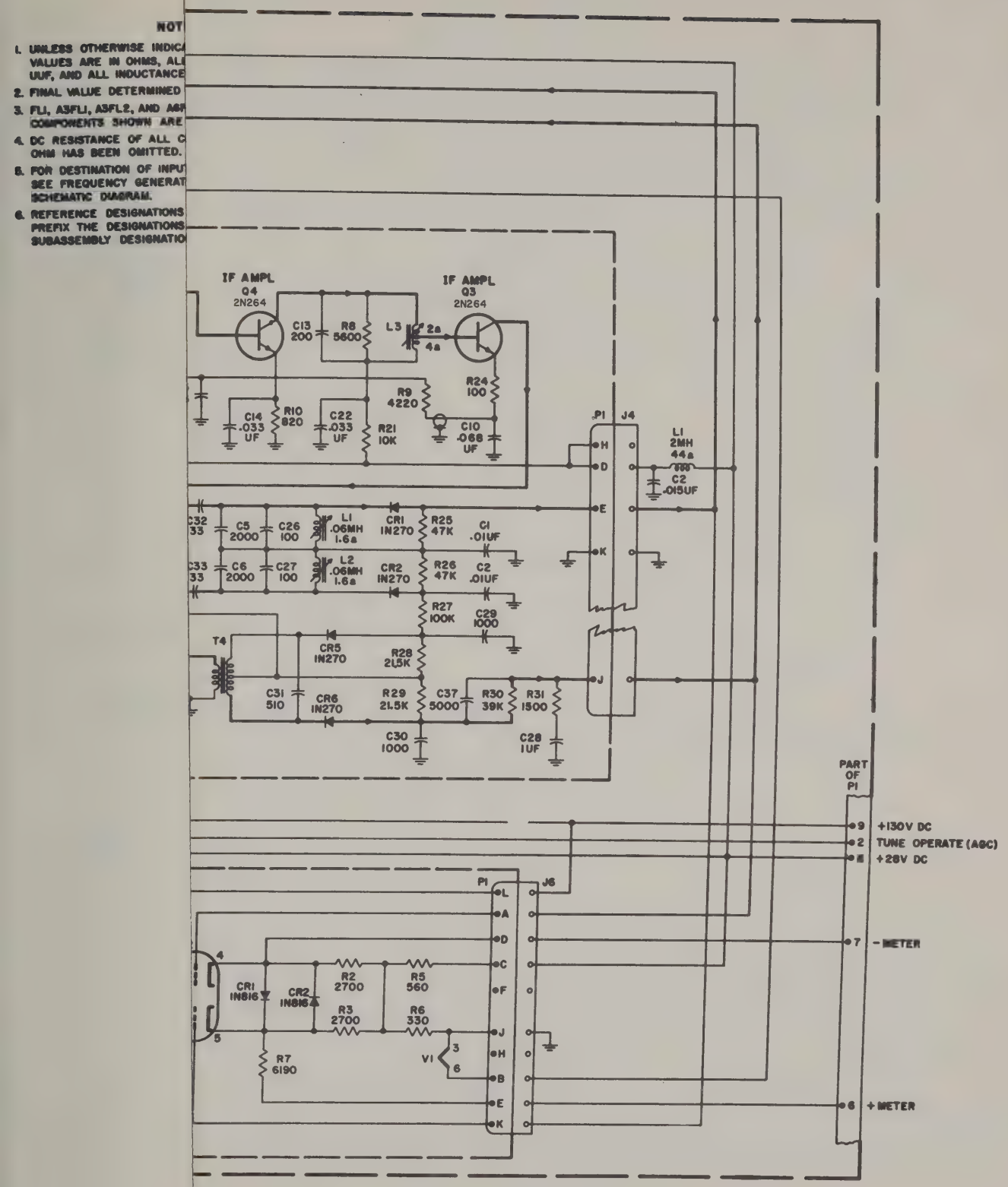


Figure 5-9. Stabilized Master Oscillator, Model C, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES IN UUF, AND ALL INDUCTANCE VALUES IN UH.
2. FINAL VALUE DETERMINED BY PRODUCTION TESTS.
3. FLI, ASFLI, ASFLE, AND AMPLI ARE NON-REPAIRABLE ITEMS. COMPONENTS SHOWN ARE REPRESENTATIVE ONLY.
4. DC RESISTANCE OF ALL COILS LESS THAN ONE OHM HAS BEEN OMITTED.
5. FOR DESTINATION OF INPUTS AND OUTPUTS OF P1, SEE FREQUENCY GENERATOR 786E-1 CHASSIS SCHEMATIC DIAGRAM.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER AND SUBASSEMBLY DESIGNATION.

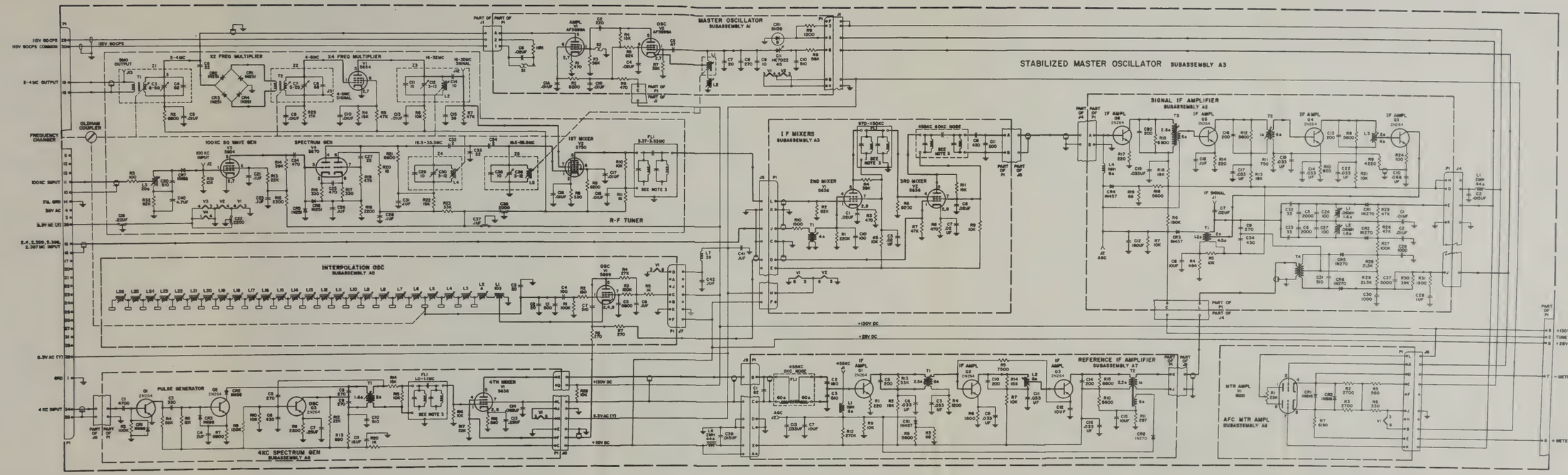


Figure 5-9. Stabilized Master Oscillator, Model C, Schematic Diagram

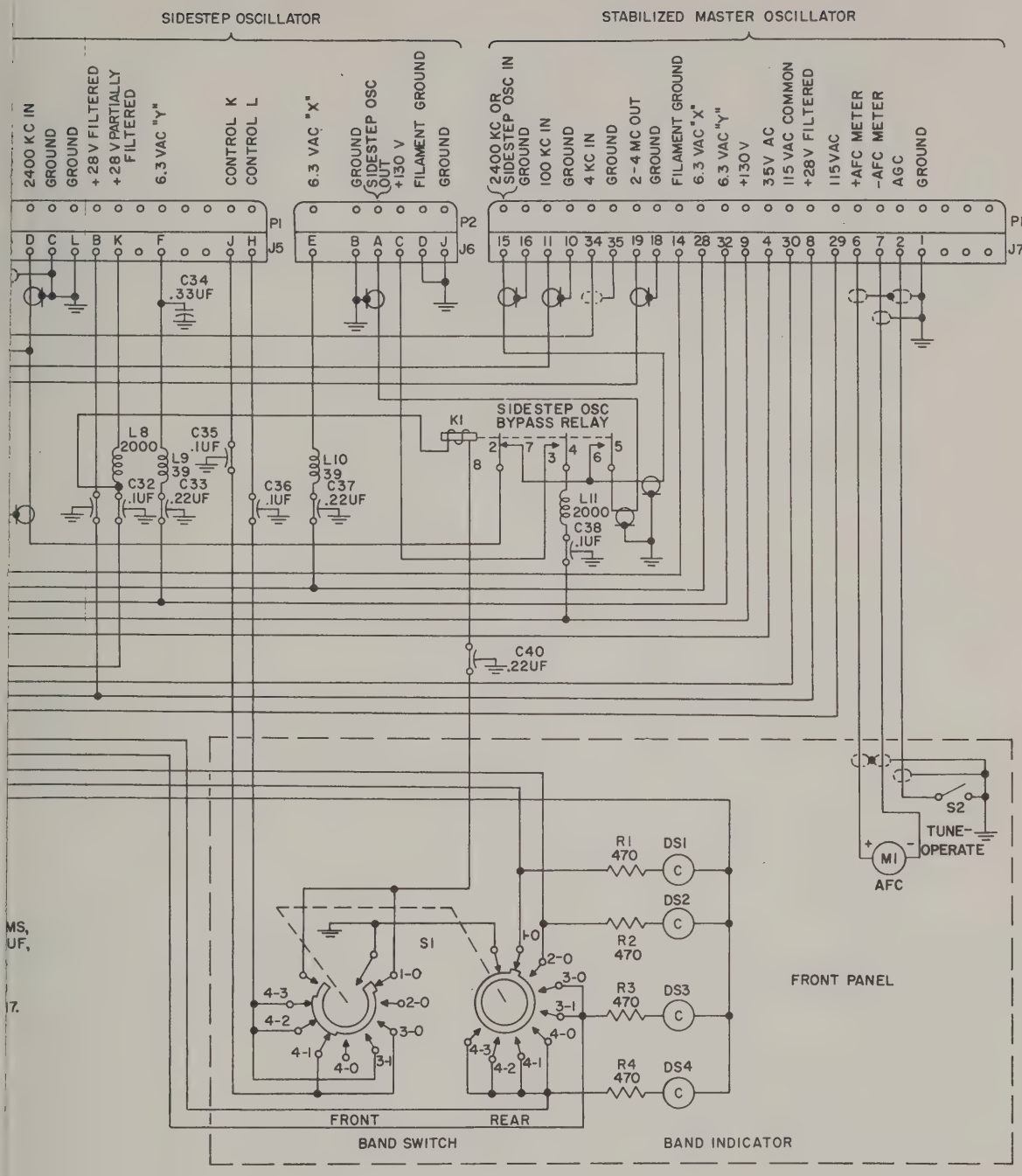


Figure 5-10. Frequency Generator 786E-1 Chassis, Schematic Diagram

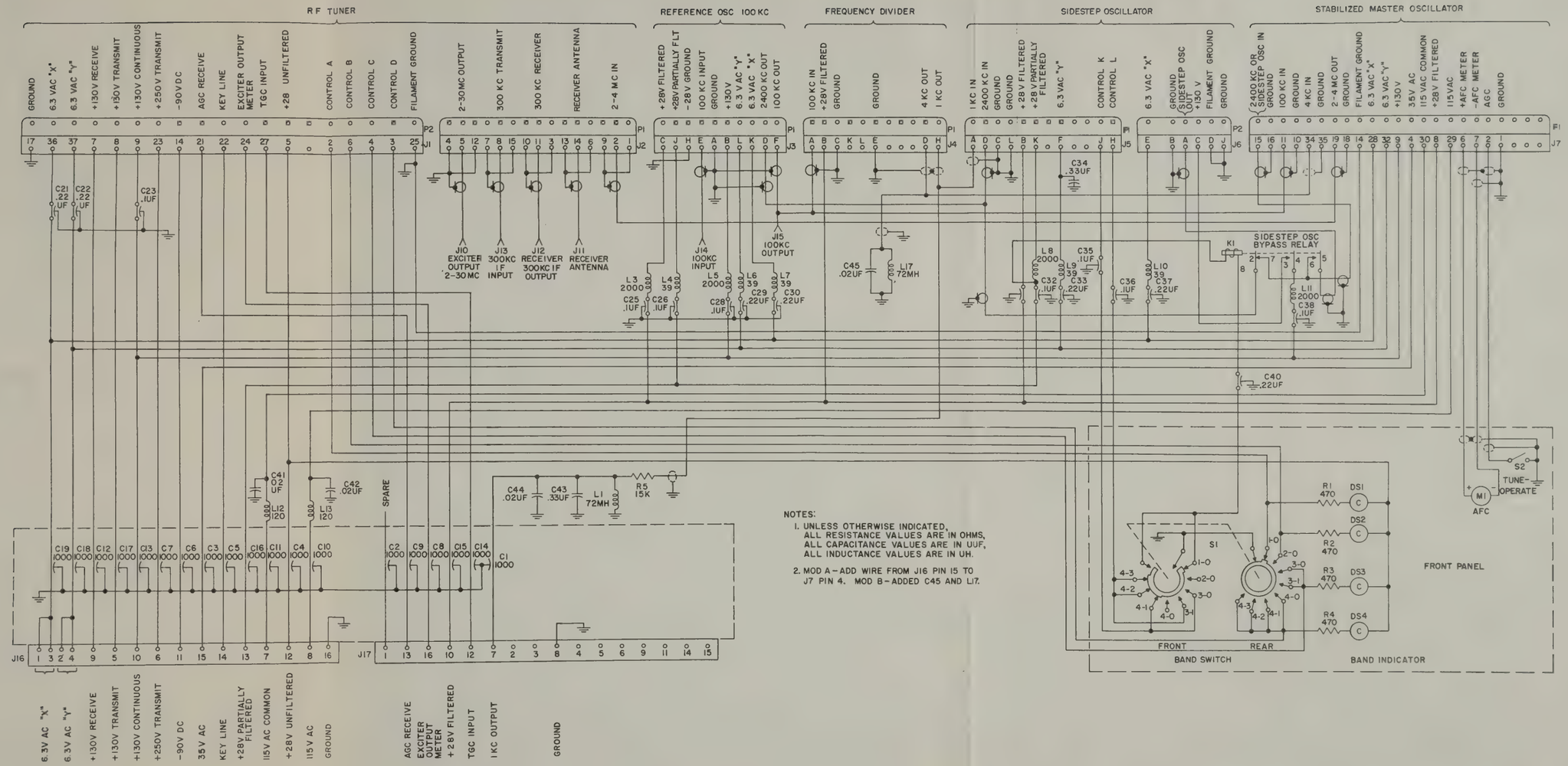


Figure 5-10. Frequency Generator 786E-1 Chassis, Schematic Diagram

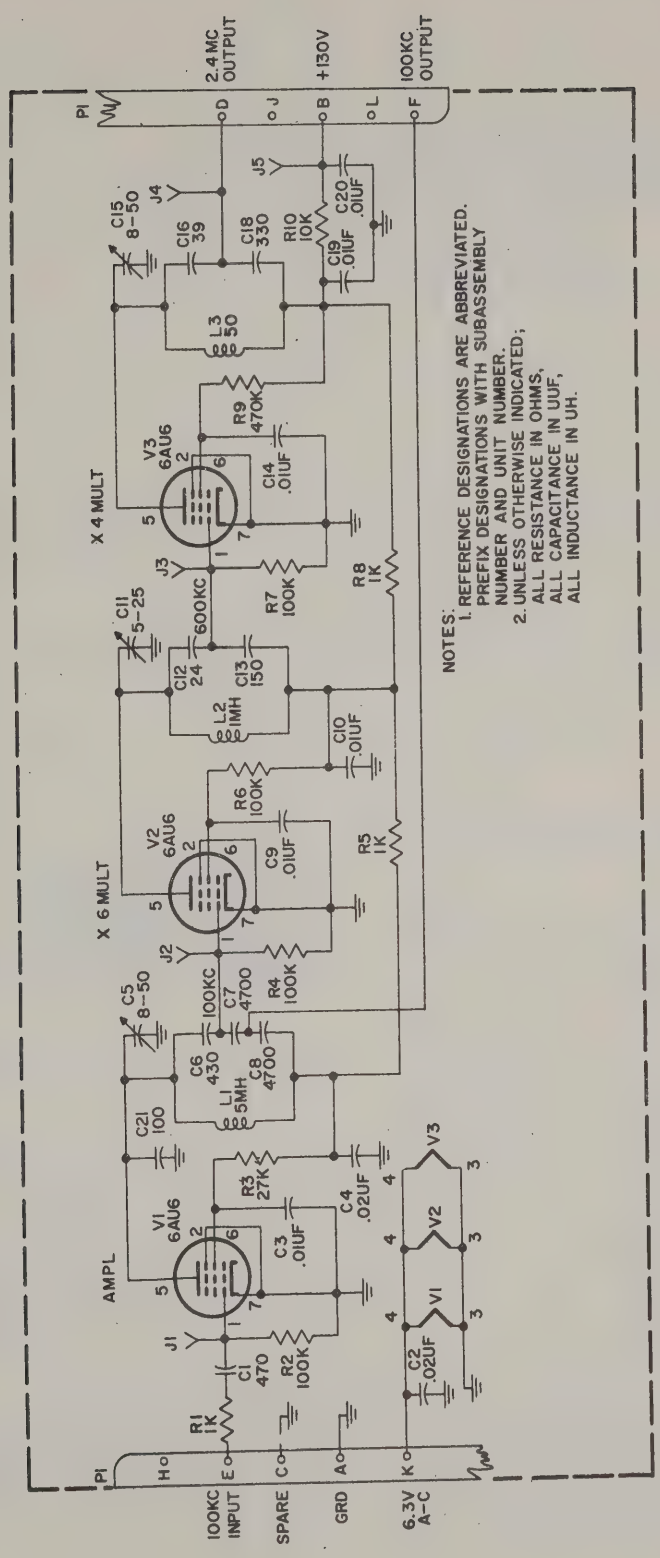


Figure 5-11. Isolation Amplifier Module, Schematic Diagram

UNIT INSTRUCTIONS

TD-115
4th EDITION, 1 APRIL 1961

LOW-VOLTAGE POWER SUPPLY

429B-1

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1958, 1959, 1961

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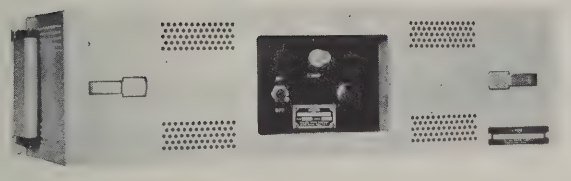


C220-77P

Figure 1. Low-Voltage Power Supply 429B-1

1.1 APPLICATION AND DESCRIPTION.

The Low-Voltage Power Supply 429B-1 provides several outputs of relatively low voltage. Among them is an a-c output of 12.6 volts, an unfiltered d-c output of +28 volts, a partly filtered d-c output of +28 volts, and one filtered d-c output each of -90, +28, +130, and +250 volts.

The unit, figure 1, is constructed for mounting in a standard 19-inch open-type rack. The chassis is hinged so that it can be swung out for maintenance. A metal cover, secured by thumb-release fasteners, provides protection of the unit. Forced air cooling is used for the unit.

1.2 TECHNICAL CHARACTERISTICS.

Weight. . . . . .23 pounds

Size . . . . . .5-1/8 inches high, 18-7/8 inches wide, 7 inches deep

Warmup period. . . .None

Voltage input . . . . .115/230 volts a-c single phase

Power input . . . . . .185 watts

Power output . . . . .+250 volts d-c filtered at 37 ma
+130 volts d-c filtered at 315 ma
+28 volts d-c unfiltered at 1.5 amp
+28 volts d-c partly filtered at 580 ma
+28 volts d-c regulated at 180 ma
-90 volts d-c filtered at 6 ma
12.6 volts a-c at 5.2 amp

1.3 SEMICONDUCTOR AND FUSE COMPLEMENT.

Table I lists all semiconductors and the fuse used in the Low-Voltage Power Supply 429B-1. Their reference symbols, type, and functions are also listed.

TABLE I. SEMICONDUCTOR AND FUSE COMPLEMENT

SYMBOL	TYPE	FUNCTION
CR1 thru CR4	1N1084	+250-volt rectifiers
CR5	1N1084	-90-volt rectifier
CR6 and CR7	1N1086	+28-volt rectifiers
CR8	1N1084	Isolation diode
CR9	1N1361A	Voltage regulator
F1	3-amp Slo Blo	Line protection

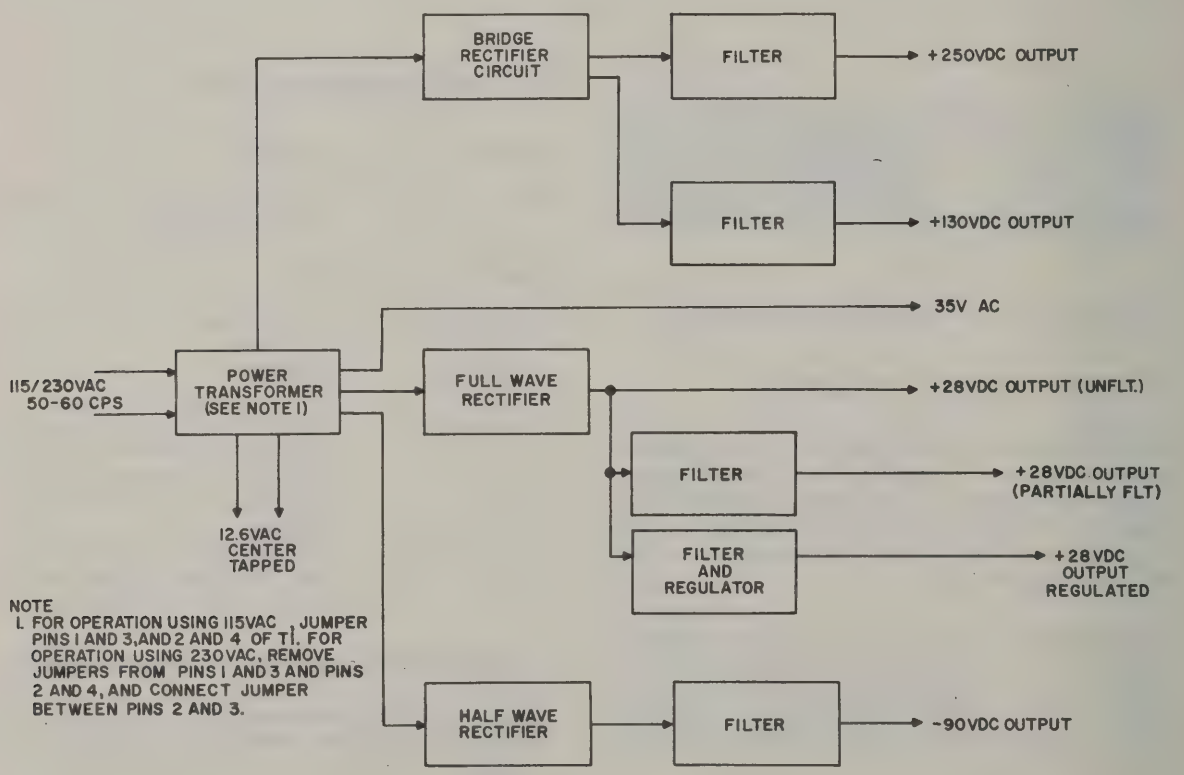
2.1 CIRCUIT DESCRIPTION.

Figure 2 is a block diagram of the Low-Voltage Power Supply 429B-1. The input voltage is applied to the primary of transformer T1 through S1. The secondary of the transformer is connected to the rectifier circuits. As shown in the block diagram, the power transformer supplies all the rectifier circuits. Schematic diagram, figure 6 shows the actual connection of the transformer secondary to the rectifiers. The +250-volt supply uses a full-wave bridge rectifier and a choke input filter. The +130-volt supply is connected to the center tap of the +250-volt supply and contains an LC filter. Indicator light DS1 is tied across the 12.6-volt a-c supply. The unfiltered +28-volt supply is taken from directly across the full-wave rectifier diodes CR6 and CR7. The partly filtered +28-volt supply is taken from across a one-section LC network. The filtered, regulated 28-volt d-c supply is isolated from the other 28-volt d-c supplies by diode CR8. This prevents C4 and C6 from discharging into the low impedance of the other supplies. After passing through an RC filter, the output voltage is clamped by Zener diode CR9 which conducts when the voltage across it rises above 27 volts d-c. The -90-volt supply uses a half-wave rectifier with an RC filter.

3.1 MAINTENANCE.

3.1.1 GENERAL.

Maintenance of the Low-Voltage Power Supply 429B-1 consists primarily of checking the line fuse and the rectifier diodes.


BRIDGE RECTIFIER CIRCUIT
FILTER
+250VDC OUTPUT
FILTER
+130VDC OUTPUT
35V AC
115/230VAC 50-60 CPS
POWER TRANSFORMER (SEE NOTE 1)
FULL WAVE RECTIFIER
+28VDC OUTPUT (UNFLT.)
FILTER
+28VDC OUTPUT (PARTIALLY FLT)
FILTER AND REGULATOR
+28VDC OUTPUT REGULATED
12.6VAC CENTER TAPPED
NOTE
1. FOR OPERATION USING 115VAC, JUMPER PINS 1 AND 3, AND 2 AND 4 OF T1. FOR OPERATION USING 230VAC, REMOVE JUMPERS FROM PINS 1 AND 3 AND PINS 2 AND 4, AND CONNECT JUMPER BETWEEN PINS 2 AND 3.
HALF WAVE RECTIFIER
FILTER
-90VDC OUTPUT

C220-29-3

Figure 2. Low-Voltage Power Supply 429B-1, Block Diagram

3.1.2 TEST EQUIPMENT REQUIRED.

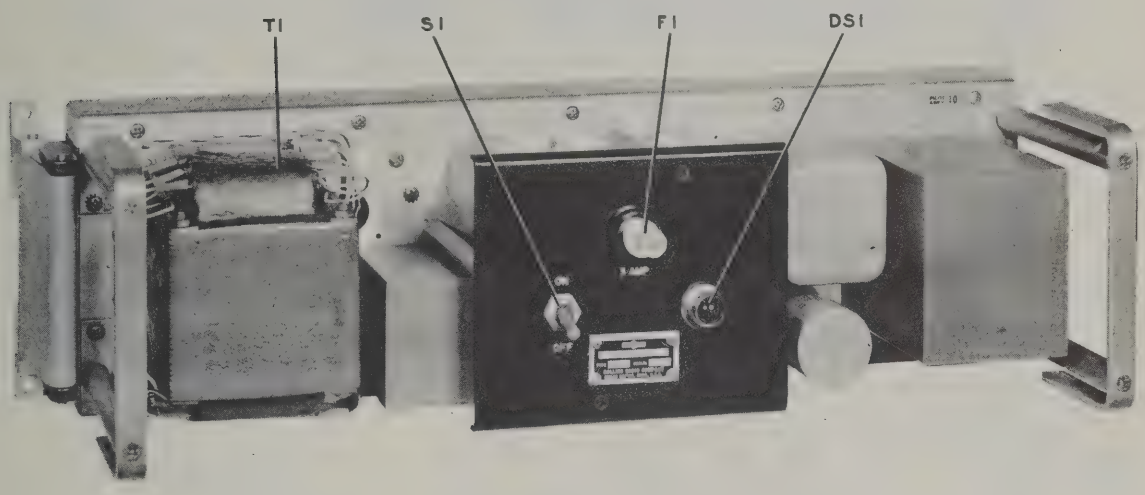
The only test equipment required to maintain the low voltage power supply is a vacuum tube voltmeter (Hewlett-Packard 410-B or equivalent).

3.1.3 TROUBLE ISOLATION.

The trouble most likely to occur in the low voltage supply is a blown fuse. If trouble is suspected in the rectifiers, the diode forward resistance and the reverse resistance may be checked with a vtvm. The resistance, using the R-times-1 scale, should be as follows:

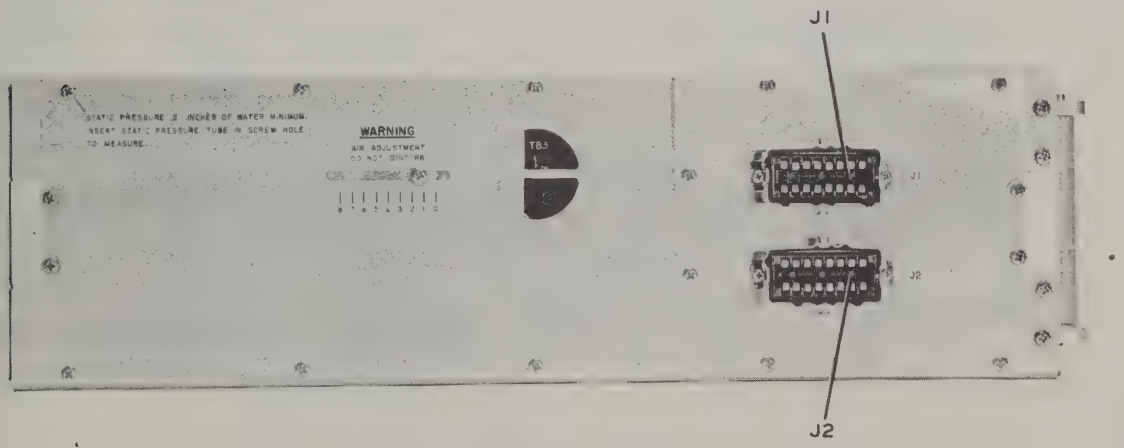
Forward - Approximately 5 ohms

Reverse - Infinite



C220-132-P

Figure 3. Low-Voltage Power Supply 429B-1, Front View, Cover Removed



C220-136-P

Figure 4. Low-Voltage Power Supply 429B-1, Rear View

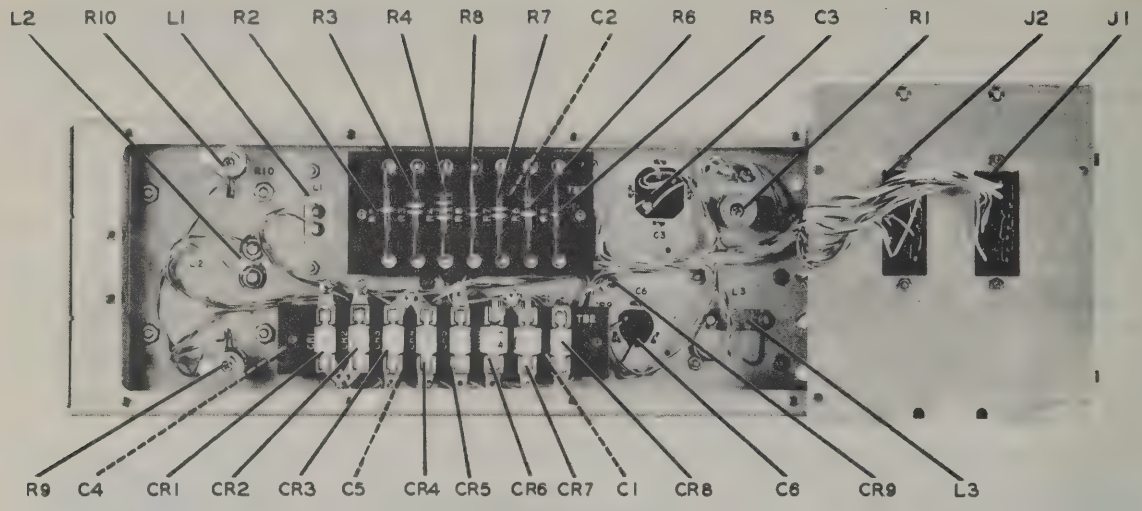
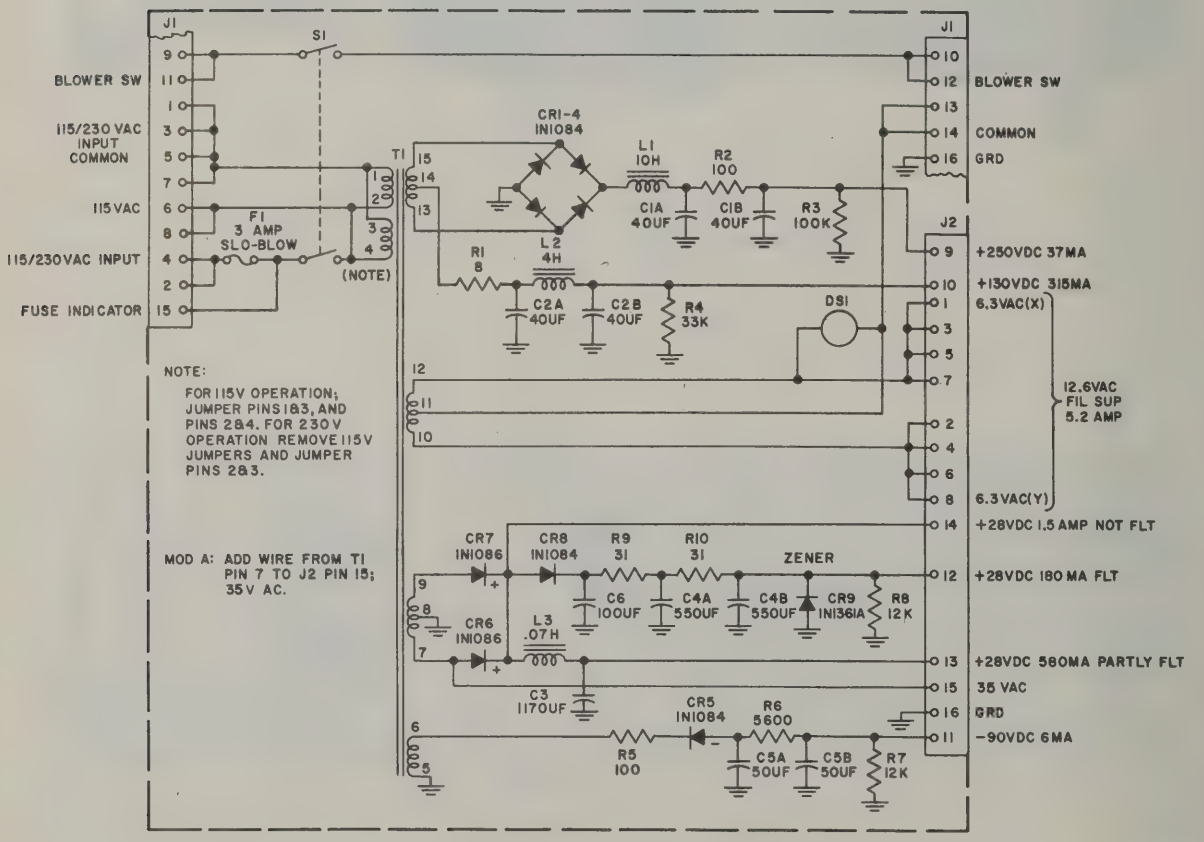


Figure 5. Low-Voltage Power Supply 429B-1, Rear View, Cover Removed

C220-137-P



C220-34-3

Figure 6. Low-Voltage Power Supply 429B-1, Schematic Diagram

PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	LOW-VOLTAGE POWER SUPPLY 429B-1	522-0862-003
C1	CAPACITOR, FIXED, ELECTROLYTIC: 2 sections; 450 vdc working, 40 uf ea section (includes C1A, C1B)	183-1009-00
C2	CAPACITOR, FIXED, ELECTROLYTIC: same as C1 (includes C2A, C2B)	183-1009-00
C3	CAPACITOR, FIXED, ELECTROLYTIC: 50 vdc working, 1170 uf	183-0014-00
C4	CAPACITOR, FIXED, ELECTROLYTIC: dual section, 50 volts, 550 uuf ea section, 1-3/8 in. dia by 3 in. lg	183-0338-00
C5	CAPACITOR, FIXED, ELECTROLYTIC: 2 sections; 200 vdc working, 50 uf ea section (includes C5A. C5B)	183-0680-00
C6	CAPACITOR, FIXED, ELECTROLYTIC: 100 v dc, 100 uf, plus 100% - 10%, metal case 1-7/64 in. dia by 2 in. lg	183-0241-00
CR1 thru CR5	SEMICONDUCTOR DEVICE, DIODE: silicon; type 1N1084	353-1567-00
CR6	SEMICONDUCTOR DEVICE, DIODE: silicon; type 1N1086	353-1558-00
CR7	SEMICONDUCTOR DEVICE, DIODE: same as CR6	353-1558-00
CR8	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-1567-00
CR9	SEMICONDUCTOR DEVICE, DIODE: zener; silicon; type 1N1361A	353-2625-00
DS1	LENS, INDICATOR LIGHT: 21/32 in. dia red w/smooth disk lens	262-2160-00
E1	TERMINAL, LUG: rd tongue shape; 0.018 in. by 5/16 in. by 23/32 in. overall	505-5038-001
F1	FUSE, CARTRIDGE: 3 amp, 250 vdc	264-4080-00
I1	LAMP, INCANDESCENT: 6.3 v, 0.945 w, 0.15 amps	262-3240-00
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: low loss plastic dielectric, 16 male contact, 5 amps at 600 vdc	372-1262-00
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: low loss plastic dielectric, 16 female contact, 5 amps at 600 vdc	372-1264-00
L1	REACTOR: 1 coil, 10 hy, 60 ma dc, 250 ohms dc	678-0499-00
L2	REACTOR: 1 coil, 4.0 hy, 0.35 amp, 55 ohms ±10%	678-0390-00
L3	REACTOR: 1 coil, 0.07 hy, 750 ma dc, 3 ohms dc	668-0275-00
L4	NOT USED	
R1	RESISTOR, FIXED, WIRE WOUND: 8.0 ohms ±5%; 11 w	747-0209-00
R2	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 2 w	745-5610-00
R3	RESISTOR, FIXED, COMPOSITION: 100,000 ohms ±10%; 2 w	745-5736-00
R4	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%; 2 w	745-5715-00
R5	RESISTOR, FIXED, COMPOSITION: 100 ohms ±10%; 1 w	745-3310-00
R6	RESISTOR, FIXED, COMPOSITION: 5600 ohms ±10%; 2 w	745-5684-00
R7	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%; 2 w	745-5698-00
R8	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%; 2 w	745-3398-00
R9	RESISTOR, FIXED, WIREWOUND: 31 ohms p/m 5%, 11 w	746-6050-00
R10	RESISTOR, FIXED, WIREWOUND: same as R9	746-6050-00
S1	SWITCH, TOGGLE: dpdt; 28 vdc + 250 vac at 30 amp	266-3060-00
T1	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: 230 v at 4.5 amp, 50 to 60 cps primary, 130 v at 0.025 amp, 70 v center tapped at 1.5 amp, 12.4 v at 5 amp, 230 v center tapped at 0.300 amp secondary	662-0278-00
TB1	TERMINAL BOARD: plastic; incl. 14 post terminals	542-7386-002
TB2	TERMINAL BOARD: plastic; incl 14 fuse clips, 16 lug terminals and 14 tubular rivets	542-7388-002
TB3	PLATE ADAPTER PRESSED: aluminum, chromate dip; 0.063 in. by 5-27/32 in. by 4-31/32 in.	544-2709-003
XF1	FUSE HOLDER: 250 v, 20 amp; accommodates one cartridge fuse	265-1040-00
XI1	LAMP HOLDER: accommodates miniature bayonet base incandescent lamp, 2 v, 0.06 amp	262-0093-00

UNIT INSTRUCTIONS

TD-497
1 DECEMBER 1960

I-F TRANSLATOR
786K-1

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1960

CEDAR RAPIDS, IOWA, U.S.A.

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SECTION I
GENERAL DESCRIPTION

1.1 APPLICATION AND DESCRIPTION.

The I-F Translator 786K-1, figure 1-1, translates the 300-kc i-f frequency received from an r-f translator to usable audio, CW or FSK outputs. It includes controls for selection of upper sideband, lower sideband, both sidebands, or AM outputs. A tunable beat frequency oscillator is included for convenient reception of CW or RTTY signals. Outputs are provided for either 4-ohm or 600-ohm speaker, as well as balanced outputs for telephone lines. Gain controls, or attenuators, control output and output line levels. A metering circuit allows selectable monitoring of agc level, either sideband channel output level, or AM output level.

The I-F Translator 786K-1 consists of a main chassis and its subassemblies and four plug-in modules. Refer to figure 1-2. The modules required for operation of the 786K-1 depend upon the desired mode of operation. The following is a list of the modules that can be used in I-F Translator 786K-1, and the mode of operation for which each module is required.

Carrier generator module (either or both sideband, suppressed carrier operation, CW operation, or FSK operation).

LSB i-f amplifier module (LSB reception).
USB i-f amplifier module (USB reception).
AM i-f amplifier module (AM reception).
Carrier Generator Module (USB or LSB reception).

When any of the modules are not used, their plugs should be replaced with a dummy plate to close the chassis air hole.

The main chassis of the I-F Translator 786K-1 mounts in a standard 19-inch open-type rack and is hinged to facilitate maintenance and adjustment. The 786K-1 is protected by a metal dust cover which is secured with thumb-release fasteners. A control panel is located on the front of the unit. All inputs and outputs are terminated with three 16-pin connectors on the rear of the unit, except for two r-f inputs which are terminated in BNC coaxial-type receptacles.

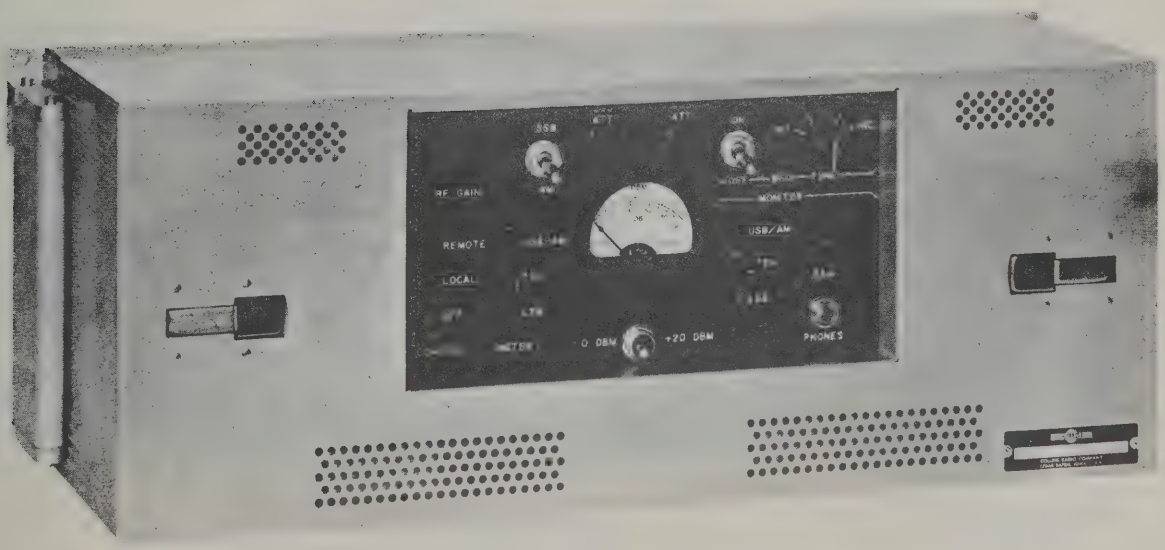


Figure 1-1. I-F Translator 786K-1

1.2 TECHNICAL CHARACTERISTICS.

Weight	14.0 pounds.
Dimensions	19 inches wide by 7 inches high, by 7 inches deep.
Required rack space	7 inches.
Power requirements	+28 volts d-c, 100 ma, less than 0.5 percent ripple. +28 volts d-c, unfiltered, 100 ma. +130 volts d-c, 125 ma, less than 0.5 percent ripple. -90 volts d-c, 1 ma, less than 0.5 percent ripple. +250 volts d-c, 15 ma, less than 0.5 percent ripple. 6.3 volts a-c, 6 cps, 2 amperes.
Signal inputs	300 kc i-f, 100 microvolts for 40-mw line output. 100 kc, 1.5 volts rms.
Signal outputs	Line: -34 to +14 dbm (adjustable) into 600-ohm balanced line. Monitor: One watt into 4- or 600-ohm speaker, with less than 5 percent total distortion.
Line level meter range	-20 to +23 dbm in two ranges.
Agc selection	Choice of either or both sidebands.
BFO range	±1 kc.
BFO stability	0.05 percent.

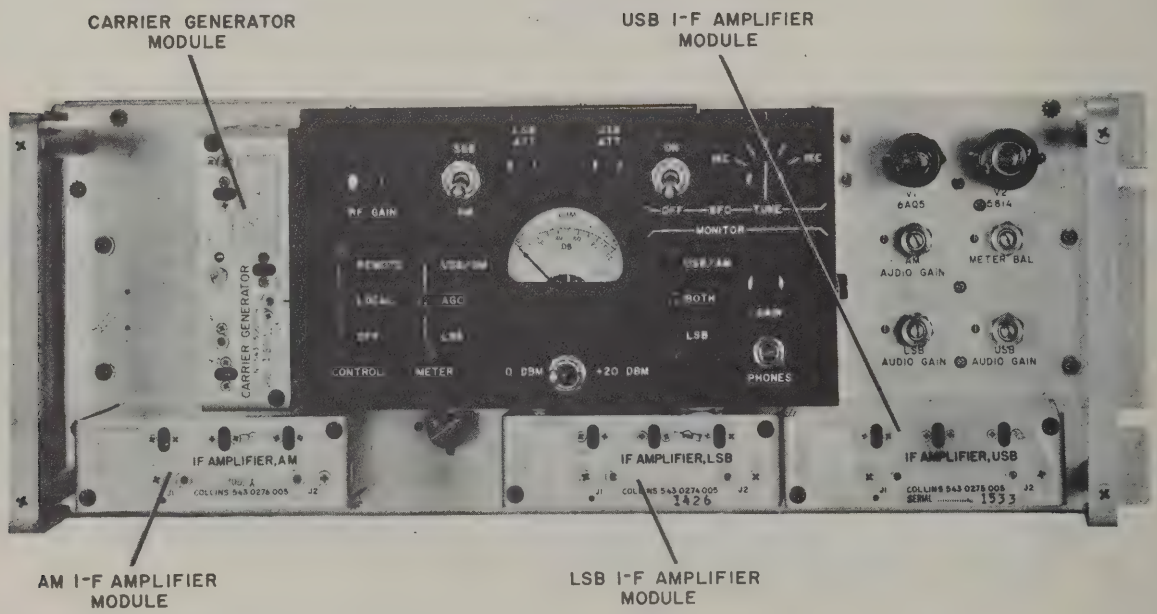


Figure 1-2. I-F Translator 786K-1, Module Location

1.3 DIODE, TRANSISTOR, AND TUBE COMPLEMENT.

Table 1-1 lists all diodes, transistors, and tubes of I-F Translator 786K-1 with symbol number, function, and location. I-F Translator 786K-1 contains no fuses.

TABLE 1-1. DIODE, TRANSISTOR, AND TUBE COMPLEMENT

LOCATION	SYMBOL	TYPE	FUNCTION
Chassis	CR1	1N457	LSB i-f gain gate
	CR2	1N457	AM i-f gain gate
	CR3	1N457	USB i-f gain gate
	CR4		Meter rectifier
	V1	6AQ5	Audio power amplifier
	V2	5821	Meter amplifier
BFO subassembly (on chassis)	CR1	1N67A	100-kc switch
	Q1	2N274	Bfo
LSB i-f amplifier module	A1CR1	1N457	Agc gate
	A1CR2	1N457	Agc detector
	A1Q1	T1904	A-f amplifier
	A1Q2	2N243	A-f power amplifier
	A1Q3	2N243	A-f power amplifier
	A1V1	5899	I-f amplifier
	A1V2	5899	I-f amplifier
	A1V3	5636	Detector
	A1V4	5899	Agc amplifier
AM i-f amplifier module	A1CR1	1N457	Agc gate
	A1CR2	1N457	Detector
	A1CR3	1N457	Agc detector
	A1Q1	TI904	A-f amplifier
	A1Q2	2N243	A-f power amplifier
	A1Q3	2N243	A-f power amplifier
	A1V1	5899	I-f amplifier
	A1V2	5899	I-f amplifier
	A1V3	5899	I-f amplifier
	A1V4	5899	Agc amplifier
USB i-f amplifier module	A2CR1	1N457	Agc gate
	A2CR2	1N457	Agc detector
	A2Q1	TI904	A-f amplifier
	A2Q2	2N243	A-f power amplifier
	A2V1	5899	I-f amplifier
	A2V2	5899	I-f amplifier
	A2V3	5636	Detector
	A2V4	5899	Agc amplifier

1.4 OPERATING CONTROLS.

Table 1-2 lists operating controls and their functions.

TABLE 1-2. FUNCTION OF OPERATING CONTROLS

CONTROL	FUNCTION
RF GAIN	Controls r-f gain and i-f gain of receiver when CONTROL switch is in LOCAL position.
CONTROL	Turns off primary power in OFF position. Normal operating position is LOCAL. The REMOTE position is used when a remote receiver r-f gain control and level meter is used.
METER	The METER switch selects the function which is indicated on the meter. In LSB position, the meter indicates the LSB audio level placed upon the output lines. In AGC position, the meter indicates the agc voltage as an indication of received signal strength. In USB/AM position, the meter indicates the USB or AM audio level placed upon the output lines.
LSB ATTENUATOR	Adjusts level of LSB audio signal placed upon output lines.
USB/AM ATTEN	Adjust level of USB or AM audio signal placed upon output lines.
BFO	Turns tunable beat frequency oscillator on or off.
SSB-AM	Selects desired mode of operation.
0 DBM - +20 DBM	Selects desired range of meter for indication of audio level on balanced output lines.
GAIN	Adjusts audio output level to headphones or to 4- to 600-ohm speaker or line.
AGC	Selects automatic gain control from either or both sideband channels.

SECTION II
CIRCUIT DESCRIPTION

2.1 GENERAL BLOCK DIAGRAM. (Figure 2-1.)

The i-f amplifier modules (LSB, USB, and AM) amplify the 300-kc i-f signal from the associated r-f tuner, demodulate the signal, and amplify the detected audio signal. A 300-kc carrier is inserted into the product detectors of the LSB and USB i-f amplifier modules from the carrier generator module. When the front panel SSB-AM switch is in the AM position, relay K1 disables the LSB and USB i-f amplifier modules and the carrier generator module. The same relay switches the AM i-f amplifier module on. The audio output from the AM i-f amplifier module is switched to the USB output lines and to the MONITOR switch for speaker output when the SSB-AM switch is in the AM position. The AM i-f amplifier module is disabled by relay K1 when the SSB-AM switch is in the SSB position. When the BFO switch is in the ON position, the diode switch CR1 (of bfo subassembly) is biased to cutoff and presents very high impedance to the 100-kc input from the external frequency standard, preventing this signal from entering the carrier generator module. The BFO switch, in ON position, also turns on the 28-volt d-c bias to transistor Q1 of the bfo subassembly. The nominal 300-kc output of Q1 then is fed to the carrier generator module to control the frequency of its operation. The carrier generator module amplifies the bfo signal for the carrier insertion to the USB or LSB i-f amplifier for CW or FSK reception. This allows the bfo to be tuned for these modes of reception. Tuning range of the bfo is approximately 299.5 to 301.5 kilocycles.

The MONITOR switch, S6, permits selection of any of the modes of reception for amplification by the audio power amplifier V1 for speaker or headphone output. The METER switch selects LSB, USB/AM output line level or agc level for indication on the meter.

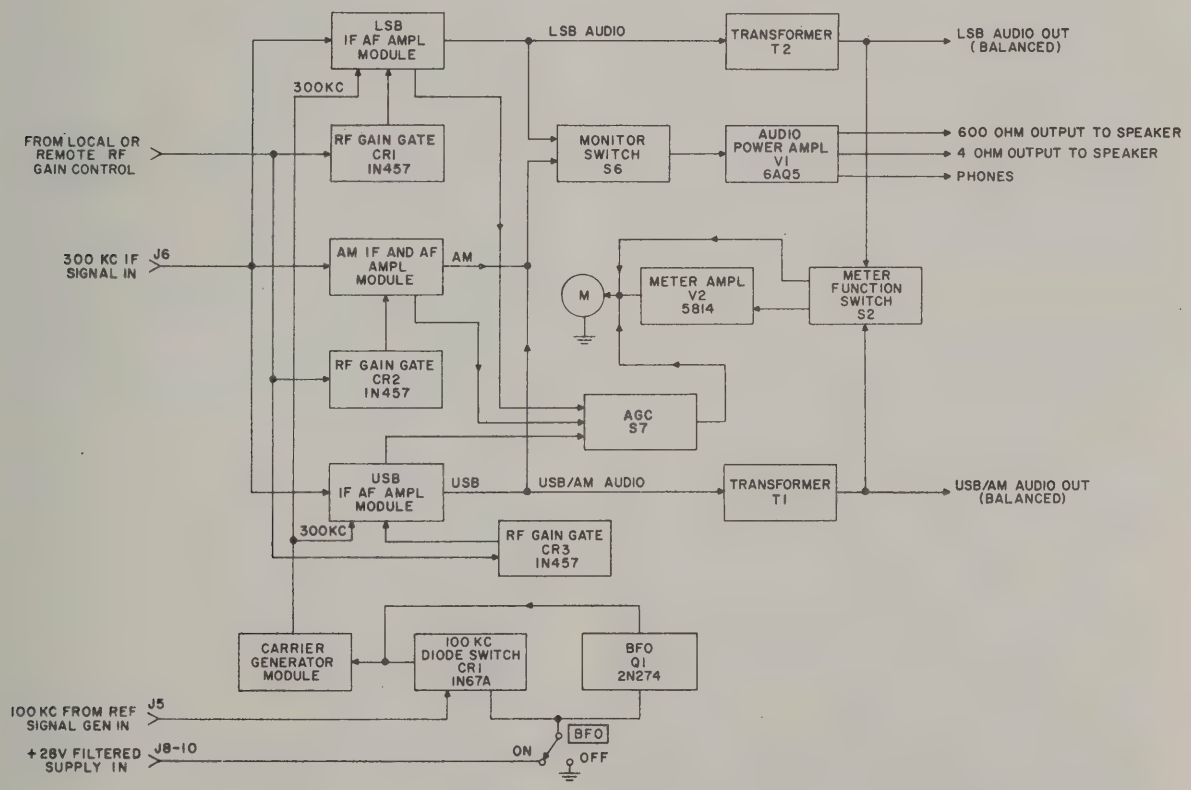


Figure 2-1. I-F Translator 786K-1, Block Diagram

2.2 CIRCUIT DETAILS.

2.2.1 CARRIER GENERATOR MODULE. (Figure 5-4.)

The carrier generator module triples the 100-kc signal from the 100-kc reference oscillator to produce the 300-kc signal necessary for r-f carrier insertion to the USB or LSB i-f amplifiers during reception of these modes. If the BFO switch on the 786K-1 panel is in ON position, the 300-kc output of the bfo subassembly is fed to the carrier generator module to control the frequency of its signal which is amplified for insertion to the same i-f amplifiers for CW or FSK reception. The 300-kc output from the carrier generator module is used by the product detectors of the two sideband amplifier modules to demodulate the i-f single-sideband or CW signal. When the BFO switch is in the OFF position, the 300-kc output of the carrier generator module has the same order of stability as that of the reference oscillator.

The 100-kc input signal to the carrier generator module is introduced through terminal K of receptacle P1, coupled through capacitor C1, and impressed on the control grid of multiplier V1. Multiplier V1 is a 5840A pentode with its plate tank circuit tuned to 300 kilocycles. Variable capacitor C5 permits tuning the tank circuit frequency. The output of the tripler is taken from a capacitive voltage divider and fed to the control grid of output amplifier V2. Amplifier V2 is operated with both triode sections in parallel. This type of operation provides a high transconductance with a consequent decrease in plate resistance, permitting higher gain and lower output impedance. Two separate 300-kc outputs are taken from the plate of V2. One output is coupled through capacitor C11 and applied to terminal A of P1, while the other output is coupled through capacitor C12 to terminal C of P1. These two 300-kc signals are used as carrier insertion in the USB and LSB i-f amplifier modules. V3 is not used for 786K-1 operation.

2.2.2 LSB I-F AMPLIFIER MODULE. (Figure 5-2.)

The LSB i-f amplifier module amplifies the i-f signal, recovers the a-f signal, and amplifies the a-f signal. The signal containing the 300-kc sideband intelligence is coupled through capacitor C1 to the control grid of the first i-f amplifier, V1, through gain control R1. The output of V1 is taken from the tuned plate circuit, L1-C5, and coupled through capacitor C6 to mechanical filter FL1. Due to a sideband inversion in the r-f tuner, filter FL1 passes a band of frequencies from 300 to 303 kilocycles, passing only the received sideband of the 300-kilocycle i-f signal. The output from FL1 is coupled through C8 and applied to the control grid of the second i-f amplifier, V2. The amplified output of V2 is coupled through i-f transformer T1 and applied to the control grid of detector V3. Detector V3 is a beat type or product detector in which a 300-kilocycle carrier signal from the carrier generator module is mixed with the 300- to 303-kilocycle lower sideband i-f signal. The difference frequencies (0 to 3 kc) are recovered as audio intelligence. The 300-kilocycle carrier is obtained from the carrier generator module and introduced into the LSB i-f amplifier module through terminal 1 of P1. This carrier signal is coupled through capacitor C12 and applied to the suppressor grid of detector V3. The a-f signal recovered from the beating action is coupled from the plate of V3 through a low-pass filter, consisting of L2, C15, and C14, which passes only the audio signal. The demodulated audio signal is coupled through C17 and C18 to the base of transistor a-f amplifier Q1. The collector output of Q1 appears across the primary winding of transformer T2, which is tuned by capacitor C19. The signal from the secondary winding of T2 drives a push-pull, class AB_2, a-f power amplifier consisting of transistors Q2 and Q3. Transformer T3 couples audio signal from the collectors of Q2 and Q3 through terminals 10 and 11 of P1 to external audio monitoring devices when output from this subassembly is selected. The small transformers used in the audio stages are subject to saturation at low frequencies. To compensate for this attenuation, negative feedback is connected to the emitter of Q1. The negative feedback reduces the gain of the stages slightly but improves the low-frequency response. The output level of the lower sideband i-f amplifier module is approximately 17 milliwatts into a 150-ohm load.

An amplified agc (automatic gain control) system is used in the lower sideband i-f amplifier to maintain a nearly constant output level. The agc voltage is derived in the following manner. A portion of the i-f signal from the secondary winding of T1 is amplified by agc amplifier V4 and rectified by crystal diode CR2. The resulting negative voltage is applied as control bias to the grids of i-f amplifiers V1 and V2. The i-f signal from the secondary winding of T1 is direct-coupled to the control grid of agc amplifier V4. The amplified output of V4 is coupled through transformer T4 to crystal diode CR2, which rectifies the signal. The rectified voltage taken from CR2 is filtered by a network consisting of C23, C24, C25, R25, and R26. The filtered, negative d-c voltage is applied through R5 and the output winding of FL1 to the control grid of V2, and through R2 and R1 to the control grid of V1. The agc voltage controls the gain of these stages by applying the most negative bias during the time of arrival of strongest signals. The agc voltage is applied through gating diode CR1 to pin 14 of P1 for application to the r-f tuner and the metering circuit of the I-F Translator 786K-1 chassis. Gating diode CR1 prevents agc interaction between the LSB i-f amplifier and the USB i-f amplifier modules, since the agc circuits are connected in parallel at the outputs. The agc filter of the LSB i-f amplifier module is a double time-constant filter. One section is of short-time duration and the other is of long-time duration. This provision is necessary to compensate for lack of an r-f carrier in the single-sideband signal. The characteristics of single-sideband operation cause voice intelligence to be transmitted in groups of r-f energy since no r-f carrier is present. Consequently, an agc action is necessary to maintain

a nearly constant operating gain of the i-f amplifiers between groups of intelligence. At the same time, agc action on the average level within the speech groups is necessary. This is accomplished by the double time-constant agc filter. The portion of the filter consisting of C24 and R26 is effective primarily between speech groups. The filter, C24-R26, provides fast attack and very slow release characteristics. The agc circuit of the LSB i-f amplifier module will limit the output of this subassembly to a maximum of 8-db rise for approximately an 80-db rise of input. Combined with the agc control in the associated r-f tuner, the agc circuit will limit the LSB i-f amplifier module output to an 8-db rise for a 100-db rise of signal at the antenna.

2.2.3 USB I-F AMPLIFIER MODULE. (Figure 5-2.)

Since the USB i-f amplifier module differs from the LSB i-f amplifier module only in the band-pass characteristics of its mechanical filter, refer to paragraph 2.2.2 for circuit description. Due to a sideband inversion in the r-f tuner, the mechanical filter, FL1, of the USB i-f amplifier module has a pass band of 297 to 300 kilocycles so that it passes only the received upper sideband of the 300-kilocycle i-f signal.

2.2.4 AM I-F AMPLIFIER MODULE. (Figure 5-3.)

The AM i-f amplifier module provides for reception of amplitude-modulated (AM) signals. The first two stages of i-f amplification are identical with the first two stages of the module described in paragraph 2.2.2, except for the pass bands of their respective filters. The mechanical filter of the AM i-f amplifier module has a 6-kilocycle pass band to accommodate a double-sideband (with carrier) AM signal, while the mechanical filters of the USB and LSB i-f amplifier modules each have a 3-kilocycle pass band for single-sideband suppressed carrier signals. An additional i-f amplifier stage provides the higher gain needed in the AM module for diode detection. The output of the third i-f amplifier is applied to a conventional AM diode detector CR1. The audio signal from the diode detector is applied to the a-f amplifier stages, which are identical to the a-f circuits used in the single sideband i-f amplifier modules.

The i-f signal is fed into the module through terminal 8 of P1. The signal from P1-8 is coupled through capacitor C27 and r-f gain control R1 to the control grid of the first i-f amplifier, V1. The amplified output of V1 is coupled from a parallel-tuned circuit consisting of L1 and C5, through capacitor C4 to mechanical filter FL1. The output of FL1 is applied to the control grid of the second i-f amplifier, V2. The output of V2 is coupled through i-f transformer T1 to the control grid of the third i-f amplifier, V3. The plate output of V3 is coupled through i-f transformer T2 to crystal diode detector CR1 and its filter network, which passes only the recovered audio signal. The audio signal is coupled through capacitor C16 to the audio amplifier stages, which are identical to those discussed in paragraph 2.2.2. The agc circuits also are identical to those discussed in paragraph 2.2.2, except for a shorter time constant. The difference in time constants is due to the fact that no transmitted carrier is available in the single-sideband modules. The r-f gain controls in the inputs of the two sideband i-f amplifier modules and in the AM i-f amplifier module permit balancing of i-f gain of the two units in use so that uniform outputs from the i-f stages are obtained.

2.2.5 BFO CIRCUIT. (Figure 5-1.)

The bfo circuit consists of a transistor oscillator and an electronic switch which disconnects the 100-kc input signal. The switching action of diode CR1 was discussed in paragraph 2.1. The bfo is energized when S4 is in the ON position. The operating voltage is applied through filter network C3, R4, and C4. The frequency of the bfo is determined by the parallel resonant circuit L1, C9, C10, C11 which is in series with the collector of Q1. Inductor L1 is adjusted for a center frequency of 300.550 kc and front panel control C11 provides a means of varying the frequency approximately ±1 kc about this center frequency. Oscillation is sustained by positive feedback from the tap on L1 to the emitter of Q1 through capacitor C7. The output of the bfo also is obtained from the L1 tap and fed to the external circuit through C8.

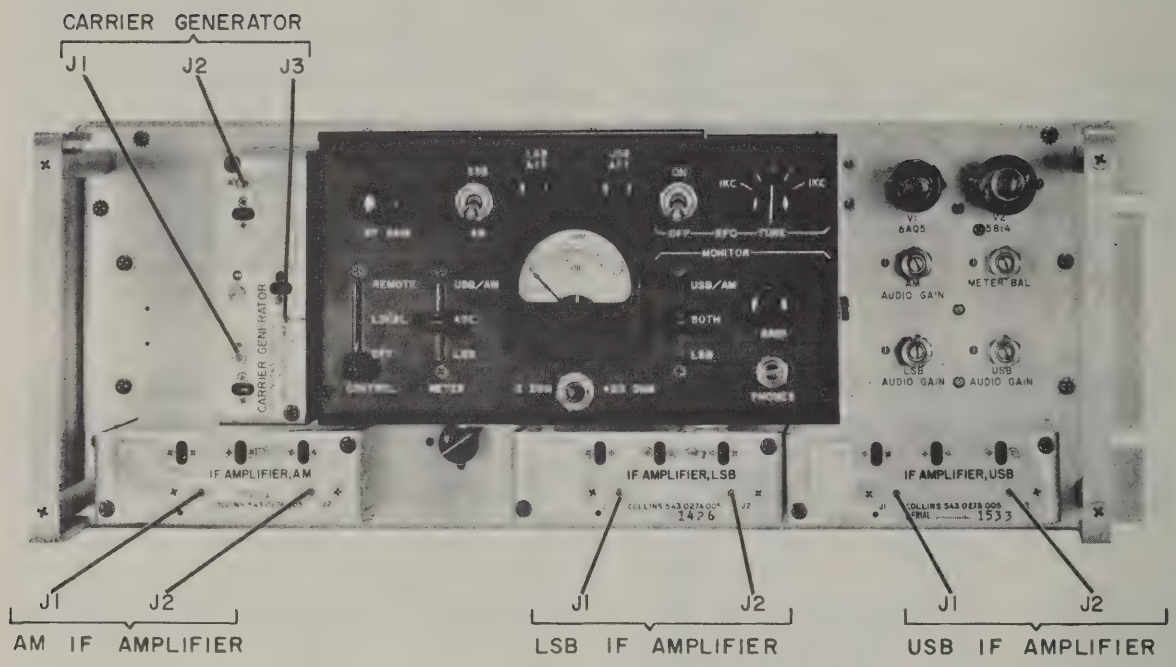


Figure 3-1. I-F Translator 786K-1, Test Point Location

SECTION III
MAINTENANCE

3.1 TEST EQUIPMENT REQUIRED.

Table 3-1 lists the test equipment required to perform the maintenance procedures contained in this section.

TABLE 3-1
TEST EQUIPMENT REQUIRED

TEST EQUIPMENT	RECOMMENDED TYPE
Vacuum-Tube Voltmeter	Hewlett-Packard 410B
Audio Oscillator	Hewlett-Packard 200CD
R-F Signal Generator	Measurements Corp. 65B
Communications Receiver	51J or equivalent
Vacuum-Tube Voltmeter	Hewlett-Packard 400D

3.2 OPERATING CHECKS.

The operation of I-F Translator 786K-1 depends upon other units of the receiver. For operating checks, refer to the operator's section of the complete receiver.

3.3 TROUBLE ISOLATION.

The proper procedure for trouble isolation is first to isolate the trouble to a defective module. The defective module then may be replaced with a good module or may be repaired by isolating the trouble to a defective part in the module. All trouble isolating is performed with I-F Translator 786K-1 installed in an operating system.

3.3.1 MODULE ISOLATION.

Table 3-2 lists the test-point voltages for locating a defective module using signal tracing procedures. Figure 3-1 shows test-point locations. A set of test points is listed for each mode of operation. For example, if trouble is suspected on USB operation, use the test points listed for the USB receive mode of operation to locate the defective module. Test-point voltages are taken with I-F Translator 786K-1 installed in an operating system and with proper injection signals applied. All a-c voltages are taken with Hewlett-Packard 400D or equivalent vtvm, and all d-c voltages are taken with a Hewlett-Packard Model 410B or equivalent vtvm.

Set the RECEIVER RF GAIN control to the maximum clockwise position. For the three receive modes of operation, inject the proper i-f signal at J6 on the chassis, and adjust the level to the value specified in table 3-2.

TABLE 3-2. MODULE TROUBLE ISOLATION TEST-POINT VOLTAGES

MODE OF OPERATION AND INJECTION SIGNAL	TEST POINT	TEST-POINT LOCATION	FREQUENCY	NORMAL SIGNAL	IF ABNORMAL
SSB	J3	Carrier Generator	300 kc	25 millivolts	Defective Carrier Generator module
USB Receive:	J6	Chassis	299 kc	100 millivolts	Adjust injection signal
Adjust signal injection for 100 microvolts at chassis J6	J2	Carrier generator	300 kc	19 volts	Defective carrier generator module
	J1	USB i-f amplifier	1000 cps	1.6 volts	Defective USB i-f amplifier module
	J2	USB i-f amplifier	Agc (d-c)	-1.0 volt	Defective USB i-f amplifier module
	J1	Carrier generator	300 kc	30 volts	Defective carrier generator

TABLE 3-2. MODULE TROUBLE ISOLATION TEST-POINT VOLTAGES (Cont)

MODE OF OPERATION AND INJECTION SIGNAL	TEST POINT	TEST-POINT LOCATION	FREQUENCY	NORMAL SIGNAL	IF ABNORMAL
LSB Receive:	J6	Chassis	301 kc	100 microvolts	Adjust injection signal
Adjust signal injection for 100 microvolts at chassis J6	J2	Carrier generator	300 kc	19 volts	Defective carrier generator module
	J1	LSB i-f amplifier	1000 cps	1.6 volts	Defective LSB i-f amplifier module
	J2	LSB i-f amplifier	Agc (d-c)	-1.0 volt	Defective LSB i-f amplifier module
	J1	Carrier generator	300 kc	30 volts	Defective carrier generator
AM Receive:	J6	Chassis	300 kc	100 microvolts	Adjust signal injection
Adjust signal injection for 100 microvolts, 30 percent modulated at 1000 cps at chassis J6	J2	Carrier generator	300 kc	0 volt	Chassis relay K1 defective
	J1	AM i-f amplifier	1000 cps	1.6 volts	Defective AM i-f module
	J2	AM i-f amplifier	Agc (d-c)	-1.0 volt	Defective AM i-f amplifier module

3.3.2 VOLTAGE AND RESISTANCE MEASUREMENTS.

Once trouble has been isolated to a module, conventional trouble-shooting procedures can be used to locate a defective part with the aid of the module schematics and the voltage and resistance measurements of table 3-3. All measurements are taken from terminal to ground with a Hewlett-Packard 410B, or equivalent vtvm, and are nominal values. All resistance measurements are taken with the module removed from the chassis. All voltages are taken with the module plugged into the chassis or connected to the chassis with pendant cables and operating with no audio or i-f signal inputs to the chassis. Readings marked with an asterisk (*) may vary widely due to diode action.

TABLE 3-3. VOLTAGE AND RESISTANCE MEASUREMENTS

TERMINAL	V D-C	V A-C	OHMS	TERMINAL	V D-C	V A-C	OHMS
CARRIER GENERATOR MODULE				CARRIER GENERATOR MODULE (Cont)			
V1-1	---	1.5	1 meg	5	4.3	0.1	820
2	0	---	0	6	---	6.3	0
3	0	---	0	7	---	2.4	22K
4	NC	NC	NC	8	130	13	80K
5	130	---	80K	V3-1	-0.62	1.2	*
6	---	6.3	15	2	0.43	0.65	Inf
7	17	---	900K	3	0	---	0
8	NC	NC	NC	4	0.43	0.65	Inf
V2-1	130	13	80K	5	95	10	85K
2	---	2.4	22K	6	---	6.3	45
3	0	---	15	7	75	---	56K
4	4.3	0.1	820	8	0.43	0.65	Inf

TABLE 3-3. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont)

TERMINAL	V D-C	V A-C	OHMS
USB I-F AMPLIFIER MODULE AND LSB I-F AMPLIFIER MODULE			
V1-1	0	---	280K*
2	NC	NC	NC
3	0	---	0
4	NC	NC	NC
5	85	---	60K
6	---	6.3	5
7	85	---	60K
8	1.25	---	150
V2-1	0	---	280K*
2	NC	NC	NC
3	---	6.3	5
4	NC	NC	NC
5	85	---	60K
6	0	---	0
7	85	---	46K
8	1.25	---	150
V3-1	0	---	7
2	NC	NC	NC
3	---	6.3	5
4	-0.6	---	100K
5	60	---	115K
6	0	---	0
7	100	---	68K
8	2.3	---	940
V4-1	0	---	7
2	NC	NC	NC
3	---	6.3	5
4	NC	NC	NC
5	85	---	46K
6	0	---	0
7	85	---	46K
8	1.25	---	150
AM I-F AMPLIFIER MODULE			
V1-1	0	---	360K*
2	NC	NC	NC
3	0	---	0
4	NC	NC	NC
5	85	---	65K
6	---	6.3	5
7	85	---	65K
8	1.25	---	150
V2-1	0	---	360K*
2	NC	NC	NC
3	---	6.3	5
4	NC	NC	NC
5	85	---	65K
6	0	---	0
7	85	---	65K
8	1.25	---	150
V3-1	0	---	7
2	NC	NC	NC
3	---	6.3	5
4	NC	NC	NC
5	85	---	65K
6	0	---	0
7	85	---	65K
8	1.25	---	150
V4-1	0	---	7
2	NC	NC	NC
3	---	6.3	5
4	NC	NC	NC
5	80	---	52K
6	0	---	0
7	80	---	0
8	1.25	---	150
Q1-e	5.3	---	6K
b	6	---	84K
c	21	---	4.1K*
Q2-e	0.25	---	22
b	1	---	100
c	27	---	1.4K*
Q3-e	0.25	---	22
b	1	---	100
c	27	---	1.4K*

3.4 ALIGNMENT AND ADJUSTMENT.

3.4.1 ALIGNMENT OF CARRIER GENERATOR MODULE.

a. Connect a vtvm to J1 on top of the carrier generator module.
b. Adjust C5 for maximum indication on the vtvm.

3.4.2 ALIGNMENT OF USB I-F AMPLIFIER MODULE.

a. Set i-f gain control R1 to its clockwise stop.
b. Ground the agc at test point J2.
c. Inject a 100-microvolt, 298.5-kc signal at J8 on the chassis.
d. Adjust L1 and T1 for maximum voltage at test point J1.
e. Remove the ground from J2, and adjust T4 for maximum agc voltage at J2.
f. Adjust i-f gain control R1 for -1.0 volt d-c at J2.

3.4.3 ALIGNMENT OF LSB I-F AMPLIFIER MODULE.

The LSB i-f amplifier module is identical to the USB i-f amplifier module except for the pass band of the

filters and the transformers. Consequently, the alignment is identical with the exception that the injection frequency for step c is 301.5 kc instead of 298.5 kc.

3.4.4 ALIGNMENT OF AM I-F AMPLIFIER MODULE.

a. Set i-f gain control R1 to its clockwise stop.
b. Ground agc at test point J2.
c. Inject a 50-microvolt, 300-kc signal at J8 on the chassis.
d. Adjust L1, T1, and T2 for maximum voltage at test point J1.
e. Remove ground from J2.
f. Raise injection signal to 100 microvolts, and adjust T5 for maximum agc voltage at J2.

3.4.5 METER BALANCE ADJUSTMENT.

a. Operate the RECEIVER RF GAIN control fully clockwise, and remove the i-f input connector from J6 on the chassis.
b. Operate the meter function switch to the AGC-TGC position, and adjust the METER BALANCE potentiometer to obtain a meter reading of 10 db.
c. Tighten the lock nut on the METER BALANCE potentiometer.

3.4.6 LSB AND USB AUDIO GAIN ADJUSTMENTS.

The following procedure is used to adjust the LSB AUDIO GAIN and USB AUDIO GAIN potentiometers. Due to a frequency inversion in the equipment, the band pass of the LSB i-f amplifier is 300 to 303 kilocycles, and the band pass of the USB i-f amplifier is 297 to 300 kilocycles. Therefore, in the following procedure the LSB gain is adjusted by injecting a 301.5-kilocycle CW signal to the input of the LSB i-f amplifier, and the USB gain is adjusted by injecting a 298.5-kilocycle CW signal to the input of the USB i-f amplifier.

a. Connect a signal generator to i-f input jack J6 on the rear of the I-F Translator 786K-1 chassis. Set the USB ATT. and LSB ATT. controls fully clockwise.
b. Using the system junction box schematic, determine which terminal board in the junction box is connected to J9 of I-F Translator 786K-1. Disconnect the jumper wires from terminals 3, 4, 5, and 6 of this terminal board. Connect a 600-ohm resistor across terminals 3 and 4. Connect a 600-ohm resistor across terminals 1 and 2.
c. Connect a vtvm across the 600-ohm resistor connected to terminals 3 and 4 above. Set the vtvm to the 10-volt a-c scale. Set the signal generator to 301.5 kilocycles CW and adjust output level to 100 microvolts. Adjust the signal generator frequency slightly for maximum reading on vtvm. Loosen the lock nut, and adjust the LSB AUDIO GAIN potentiometer for a reading of 3.5 volts a-c on the vtvm. Tighten the lock nut.
d. Connect a vtvm across the 600-ohm resistor connected to terminals 1 and 2 above. Set the signal generator to 298.5 kilocycles CW and adjust output level to 100 microvolts. Adjust the signal generator frequency slightly for maximum reading on the vtvm. Loosen the lock nut, and adjust USB AUDIO GAIN potentiometer for a reading of 3.5 volts a-c on the vtvm. Tighten the lock nut.
e. Remove the 600-ohm resistors from terminals 3, 4, 1, and 2 and reconnect jumper wires. Remove the signal generator and reconnect coaxial cable to J6.

SECTION IV
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	786K-1 I-F TRANSLATOR CHASSIS ASS'Y	522-1906-00
C1	CAPACITOR, FIXED, CERAMIC: 1000 uuf, +80% -20%, 500 v dc	913-1292-00
C2 thru C24	CAPACITOR, FIXED, CERAMIC: same as C1	913-1292-00
C25	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf, -0% +100%, 5 v dc	183-1369-00
C26	CAPACITOR, FIXED, PAPER: 0.047 uf, ±20%, 100 v dc	931-9079-00
C27	CAPACITOR, FIXED, PAPER: same as C26	931-9079-00
C28	CAPACITOR, FIXED, CERAMIC: 2200 uuf, +100% -20%, 500 v dc	913-1192-00
CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft type 1N457	353-0204-00
CR2	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-0204-00
CR3	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-0204-00
CR4	RECTIFIER, METALLIC: copper oxide; single phase, full wave bridge connected; 5 v rms max; 5 ma normal output; -25°C to +80°C ambient temp range	353-0130-00
E1	TERMINAL, STUD: melamine, insulated, tapped insert type; 1/4 in. w, 0.7882 in. lg hex	306-0233-00
E2 thru E8	TERMINAL, STUD: same as E1	306-0233-00
E9	SHIELD, ELECTRON TUBE: 7 pin large, brass; incl copper insert and hold-down spring	541-6552-003
E10	SHIELD, ELECTRON TUBE: 9 pin medium; cylindrical w/ flared end; open top; brass; 0.95 in. by 1.065 in.; incl beryllium copper insert	541-6554-003
H1	WASHER, FLAT: steel; 0.017 in. thk by 0.095 in. id by 0.250 in. od	506-7367-002
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 12 flat female contacts, 3 amps, straight shape	372-1550-00
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: socket insert, 15 rd female contacts, 5 amps, straight shape	371-0041-00
J3	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J2	371-0041-00
J4	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J2	371-0041-00
J5	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 female contact, 50 ohms; straight shape	357-9183-00
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J5	357-9183-00
J7	JACK, TELEPHONE: accommodates 1/4 in. dia plug; cadmium plated frame and bushing; nut and washer furnished	360-0025-00
J8	CONNECTOR, RECEPTACLE, ELECTRICAL: 16 female contacts, 5 amps at 600 v dc; straight shape	372-1262-00
J9	CONNECTOR, RECEPTACLE, ELECTRICAL: 16 flat female contacts; 5 amps, 600 v dc; straight shape	372-1264-00
K1	RELAY, ARMATURE: 4C contact arrangement, 32 v dc, 3 amps at 30 v dc or 115 v ac, 300 ohms, ±20%	972-1335-00
M1	AMMETER: panel type; dc; 0-200 meter range; ±3% accuracy; 360 ohms, 2-1/2 in. square plastic case	458-0570-00
O1	KNOB: setscrew type; 11/16 in. max od by 13/32 in. thk; black body	281-0294-00
O2	KNOB: same as O1	281-0294-00
O3	KNOB: same as O1	281-0294-00
O4	KNOB: screw on type; plain gripping surface; black cast phenolic body; 1/2 in. lg by 3/8 in. dia; brass insert tapped 8-32 by 11/32 min. thd depth	281-0330-00
O5	KNOB: same as O4	281-0330-00
O6	KNOB: same as O4	281-0330-00
P1	TERMINAL BOARD: phenolic; 3/32 in. thk by 1-3/4 in. w by 4-15/16 in. lg; 18 brass, silver plated, double end terminal lugs mtd on board	545-7652-003
R1	RESISTOR, FIXED, COMPOSITION: 0.10 megohms, ±10%, 1/2 w	745-1436-00
R2	RESISTOR, VARIABLE: 50,000 ohms, ±20%, 1 w	380-1302-00
R3	NOT USED	
R4	RESISTOR, FIXED, COMPOSITION: 1500 ohms, ±10%, 1/2 w	745-1359-00
R5	NOT USED	
R6	RESISTOR, FIXED, COMPOSITION: same as R4	745-1359-00
R7	NOT USED	
R8	RESISTOR, FIXED, COMPOSITION: 0.47 megohms, ±10%, 1/2 w	745-1464-00
R9	RESISTOR, VARIABLE: composition; 5000 ohms ±20%, 1 w	380-5255-00
R10	RESISTOR, FIXED, COMPOSITION: same as R8	745-1464-00
R11	RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%, 1/2 w	745-1478-00
R12	RESISTOR, FIXED, COMPOSITION: 820 ohms, ±10%, 1/2 w	745-1349-00
R13	RESISTOR, FIXED, COMPOSITION: same as R12	745-1349-00
R14	RESISTOR, VARIABLE: composition; 500,000 ohms, ±20%, 1 w	380-5290-00
R15	RESISTOR, VARIABLE: same as R14	380-5290-00
R16	RESISTOR, VARIABLE: composition; 100,000 ohms, ±20%, 2 w	380-0677-00
R17	RESISTOR, VARIABLE: same as R14	380-5290-00
R18	RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%, 2 w	745-9013-00
R19	RESISTOR, FIXED, COMPOSITION: 390 ohms, ±10%, 1 w	745-3335-00
R20	RESISTOR, FIXED, COMPOSITION: same as R12	745-1349-00
R21	RESISTOR, FIXED, COMPOSITION: same as R12	745-1349-00
R22	RESISTOR, FIXED, FILM: 28.7 ohms, ±1%, 1/4 w	705-7022-00
R23	RESISTOR, FIXED, FILM: 23.7 ohms ±1%, 1/4 w	705-7018-00
R24	RESISTOR, FIXED, FILM: 51.1 ohms, ±1%, 1/4 w	705-7034-00
R25	RESISTOR, FIXED, FILM: 56.2 ohms, ±1%, 1/4 w	705-7036-00
R26 ABC	ATTENUATOR, VARIABLE: bal "H" bridged; 600 ohms input, 600 ohms output; 2 w; 1000 cps; 0.56 db ±7 db attenuation	383-0056-00
R27 ABC	ATTENUATOR, VARIABLE: same as R26ABC	383-0056-00
R28	RESISTOR, FIXED, FILM: 301 ohms, ±1%, 1/4 w	705-7071-00
R29 thru R35	RESISTOR, FIXED, FILM: same as R28	705-7071-00
R36	RESISTOR, FIXED, FILM: 11,000 ohms, ±1%, 1/4 w	705-7146-00
S1	SWITCH, ROTARY: phenolic insulation, 1 section with 30° detent, 5 circuits, 3 positions; 5 moving contacts, 20 fixed contacts	259-1182-00
S2	SWITCH, ROTARY: same as S1	259-1182-00
S3	SWITCH, TOGGLE: spst; 40 amps; 41/64 in. by 1-1/16 in. by 1-9/64 in. overall	266-3072-00
S4	SWITCH, TOGGLE: same as S3	266-3072-00
S5	SWITCH, TOGGLE: dpdt; dc rating 250 v max, 0.5 amp resistive current rating; 20 amp max nom current, 30 v; ac rating, 220 v max, 9 amps resistive current rating, 25 amp max current, 115 v	266-3060-00
S6	SWITCH, ROTARY: same as S1	259-1184-00
S7	SWITCH, ROTARY: phenolic insulation, 1 section with 30° detent; 2 circuits, 3 positions; 2 moving contacts, 8 fixed contacts	259-1184-00
T1	TRANSFORMER, AUDIO FREQUENCY: line type; 600 ohms center tapped primary, 150 ohms secondary; 200 mw operating level	667-0262-00
T2	TRANSFORMER, AUDIO FREQUENCY: same as T1	667-0262-00
T3	TRANSFORMER, AUDIO FREQUENCY: metal encased; 600 ohms primary tapped at 250 ohms; 30/15,000 cps; 80,000 ohms secondary, CT; solder type terminals	667-0462-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
T4	TRANSFORMER, AUDIO FREQUENCY: line type, primary 5000 ohms, secondary 500 ohms tapped 4 ohms primary, 35 ma, secondary zero	667-0018-00
V1	ELECTRON TUBE: glass envelope; pentode; RCA type 6AQ5	255-0195-00
V2	ELECTRON TUBE: type 12AU7; General Electric	253-0013-00
XV1	SOCKET, ELECTRON TUBE: 7 pin miniature, brass and copper w/ phenolic insulation	220-1291-00
XV2	SOCKET, ELECTRON TUBE: 9 contact miniature, 0.043 min. wire hole size	220-1293-00
	MOUNTING KIT: 4 in. by 6 in. approx; consists of the following:	541-1477-002
	BAG, COTTON, DUCK: approx 4 in. by 6 in. w/ drawstring (qty 1)	024-0100-00
	WASHER, LOCK: CRES; split helical ring; 0.168 in. id, 0.296 in. od, 0.040 in. thk (qty 2)	310-0072-00
	WASHER, FLAT: stainless steel; 0.227 in. id, 0.500 in. od, 0.040 in. thk (qty 8)	310-0167-00
	WASHER, LOCK: type 302 stainless steel; split helical ring; 0.221 in. id, 0.380 in. od, 0.056 in. thk (qty 8)	310-0286-00
	SCREW, MACHINE: stainless steel, passivate finish; cross recessed pan head; 8(0.164) in. -32 NC-2A thd, 3/8 in. lg (qty 2)	343-0187-00
	SCREW, MACHINE: stainless steel; passivate finish; cross recessed pan head; 12(0.216) in. -24 NC-2A thd; 1/2 in. lg (qty 8)	343-0247-00
	BEAT FREQUENCY OSCILLATOR (Module A1)	543-3124-00
A1C1	CAPACITOR, FIXED, CERAMIC: 1000 uuf, plus 80% -20%, 500 v dc	913-1292-00
A1C2	CAPACITOR, FIXED, CERAMIC: same as A1C1	913-1292-00
A1C3	CAPACITOR, FIXED, CERAMIC: same as A1C1	913-1292-00
A1C4	CAPACITOR, FIXED, ELECTROLYTIC: 1.0 uf, ±20%, 35 v dc	184-7398-00
A1C5	CAPACITOR, FIXED, CERAMIC: 4700 uuf, plus 100% -20%, 500 v dc	913-1187-00
A1C6	CAPACITOR, FIXED, MICA: 2200 uuf, ±2%, 500 v dc	912-3338-00
A1C7	CAPACITOR, FIXED, MICA: 3900 uuf, ±2%, 500 v dc	912-3359-00
A1C8	CAPACITOR, FIXED, MICA: 56 uuf, ±2%, 500 v dc	912-2797-00
A1C9	CAPACITOR, FIXED, MICA: same as A1C6	912-3338-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0059-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0060-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0061-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0062-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0063-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0064-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0065-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0066-00
A1C10	CAPACITOR, FIXED, CERAMIC: 50 uuf, ±2%, 500 v dc	913-0237-00
A1C11	CAPACITOR, VARIABLE, AIR: 5 uuf min to 50 uuf max, 600 v rms ac, 60 cps	922-0520-00
A1CR1	SEMICONDUCTOR DEVICE DIODE: germanium; type 1N67A	353-2015-00
A1E1	TERMINAL BOARD: plastic, copper clad; 1.796 in. w by 3 in. lg overall; incl six brass, gold plated terminals and 35 flared tubelets	545-3139-004
A1L1	TRANSFORMER, RADIO FREQUENCY: 3 windings, 55 turns each, tapped at 25 turns first winding, 300 kc	545-3143-003
A1Q1	TRANSISTOR: germanium; 2N274	352-0096-00
A1R1	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, ±10%, 1/2 w	745-1429-00
A1R2	RESISTOR, FIXED, COMPOSITION: 6800 ohms, ±10%, 1/4 w	745-0779-00
A1R3	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%, 1/4 w	745-0797-00
A1R4	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±10%, 1/4 w	745-0785-00
A1R5	RESISTOR, FIXED, COMPOSITION: 12,000 ohms, ±10%, 1/4 w	745-0788-00
A1R6	RESISTOR, FIXED, COMPOSITION: same as A1R2	745-0779-00
A1R7	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, ±10%, 1/4 w	745-0791-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
	LSB I-F AMPLIFIER (Module A2)	543-0274-005
A2C1	CAPACITOR, FIXED, PAPER: 10,000 uuf, ±20%, 100 v dc	931-4481-00
A2C2	CAPACITOR, FIXED, PAPER: 15,000 uuf, ±20%, 100 v dc	931-5641-00
A2C3	CAPACITOR, FIXED, PAPER: 100,000 uuf, ±20%, 200 v dc	931-5892-00
A2C4	CAPACITOR, FIXED, PAPER: 33,000 uuf, ±20%, 200 v dc	931-5893-00
A2C5	CAPACITOR, FIXED, MICA: 180 uuf, ±2%, 500 v dc	912-1850-00
A2C6	CAPACITOR, FIXED, PAPER: same as A2C1	931-4481-00
A2C7	CAPACITOR, FIXED, PAPER: same as A2C2	931-5641-00
A2C8	CAPACITOR, FIXED, MICA: 91 uuf, ±2%, 500 v dc	912-1829-00
A2C9	CAPACITOR, FIXED, PAPER: same as A2C3	931-5892-00
A2C10	CAPACITOR, FIXED, PAPER: same as A2C4	931-5893-00
A2C11	CAPACITOR, FIXED, MICA: 510 uf, ±2%, 300 v dc	912-1883-00
A2C12	CAPACITOR, FIXED, PAPER: same as A2C1	931-4481-00
A2C13	CAPACITOR, FIXED, PAPER: same as A2C3	931-5892-00
A2C14	CAPACITOR, FIXED, MICA: same as A2C11	912-1883-00
A2C15	CAPACITOR, FIXED, PAPER: 2200 uuf, ±20%, 600 v dc	931-4564-00
A2C16	CAPACITOR, FIXED, ELECTROLYTIC: 4 uf, +75% -15%, 150 v dc	184-7043-00
A2C17	CAPACITOR, FIXED, PAPER: 33,000 uuf, ±20%, 200 v dc	931-5941-00
A2C18	CAPACITOR, FIXED, PAPER: 4700 uuf, ±20%, 300 v dc	931-4522-00
A2C19	CAPACITOR, FIXED, MICA: same as A2C11	912-1883-00
A2C20	CAPACITOR, FIXED, ELECTROLYTIC: 18 uf, +75% -15%, 50 v dc	184-7036-00
A2C21	CAPACITOR, FIXED, ELECTROLYTIC: 60 uf, ±20%, 6 v dc	184-7370-00
A2C22	CAPACITOR, FIXED, ELECTROLYTIC: same as A2C21	184-7370-00
A2C23	CAPACITOR, FIXED, ELECTROLYTIC: 220,000 uuf, ±20%, 20 v dc	184-7376-00
A2C24	CAPACITOR, FIXED, ELECTROLYTIC: 2.2 uf, ±20%, 20 v dc	184-7377-00
A2C25	CAPACITOR, FIXED, MICA: 330 uuf, ±2%, 500 v dc	912-1868-00
A2C26	CAPACITOR, FIXED, PAPER: same as A2C3	931-5892-00
A2C27	CAPACITOR, FIXED, MICA: 300 uuf, ±2%, 500 v dc	912-1865-00
A2C28	CAPACITOR, FIXED, PAPER: same as A2C4	931-5893-00
A2C29	CAPACITOR, FIXED, PAPER: same as A2C3	931-5892-00
A2CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type 1N457	353-0204-00
A2CR2	SEMICONDUCTOR DEVICE, DIODE: same as A2CR1	353-0204-00
A2E1	SHIELD, ELECTRON TUBE: accommodates tube envelope style T-9	141-0223-00
A2E2 thru A2E4	SHIELD, ELECTRON TUBE: aluminum; 0.465 in. id, 0.495 in. od, 1-7/16 in. lg; incl insert	542-4782-002
A2FL1	FILTER, BAND PASS: 300 kc; 2.6 kc bandwidth at 2.5 db, 7.5 kc bandwidth at 60 db; 35,000 ohms input, 14,000 ohms ouput lower	526-9312-00
A2J1	JACK, TIP: standard phone tip accommodated; teflon insulation	360-0129-00
A2J2	JACK, TIP: same as A2J1	360-0129-00
A2L1	COIL, RADIO FREQUENCY: copper magnet wire; 3 to 5 mh	278-0266-00
A2L2	COIL, RADIO FREQUENCY: copper magnet wire; 25 mh	278-0267-00
A2P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts; 5 amps; straight	371-0020-00
A2Q1	TRANSISTOR: silicon; Bogue Electric part no. 2N161	352-0076-00
A2Q2	TRANSISTOR: silicon; Texas Instruments Co. type no. 2N243	352-0042-00
A2Q3	TRANSISTOR: same as A2Q2	352-0042-00
A2R1	RESISTOR, VARIABLE, WIREWOUND: 1000 ohms, ±10%, 0.4 w	381-1111-00
A2R2	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%, 1/4 w	745-0408-00
A2R3	RESISTOR, FIXED, COMPOSITION: 150 ohms, ±10%, 1/4 w	745-0317-00
A2R4	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1 w	745-3384-00
A2R5	RESISTOR, FIXED, COMPOSITION: same as A2R2	745-0408-00
A2R6	RESISTOR, FIXED, COMPOSITION: same as A2R3	745-0317-00
A2R7	RESISTOR, FIXED, COMPOSITION: same as A2R4	745-3384-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A2R8	NOT USED	
A2R9	RESISTOR, FIXED, COMPOSITION: 47, 000 ohms, ±10%, 1/4 w	745-0422-00
A2R10	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms, ±10%, 1/4 w	745-0436-00
A2R11	NOT USED	
A2R12	RESISTOR, FIXED, COMPOSITION: 330 ohms, ±10%, 1/4 w	745-0331-00
A2R13	RESISTOR, FIXED, COMPOSITION: 47, 000 ohms, ±10%, 1/2 w	745-1422-00
A2R14	RESISTOR, FIXED, COMPOSITION: 15, 000 ohms, ±10%, 1 w	745-3401-00
A2R15	RESISTOR, FIXED, COMPOSITION: 180, 000 ohms, ±10%, 1/4 w	745-0447-00
A2R16	RESISTOR, FIXED, COMPOSITION: 150, 000 ohms, ±10%, 1/4 w	745-0443-00
A2R17	RESISTOR, FIXED, COMPOSITION: 6800 ohms, ±10%, 1/4 w	745-0387-00
A2R18	NOT USED	
A2R19	RESISTOR, FIXED, COMPOSITION: 2000 ohms, ±5%, 1 w	745-3364-00
A2R20	RESISTOR, FIXED, COMPOSITION: 390 ohms, ±10%, 2 w	745-5635-00
A2R21	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%, 1/2 w	745-1310-00
A2R22	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±10%, 1/2 w	745-1282-00
A2R23	RESISTOR, FIXED, COMPOSITION: same as A2R22	745-1282-00
A2R24	RESISTOR, FIXED, COMPOSITION: 39, 000 ohms, ±10%, 1/4 w	745-0419-00
A2R25	RESISTOR, FIXED, COMPOSITION: 0.33 megohms, ±10%, 1/4 w	745-0457-00
A2R26	RESISTOR, FIXED, COMPOSITION: 1.0 megohm, ±10%, 1/4 w	745-0478-00
A2R27	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms, ±10%, 1/4 w	745-0394-00
A2R28	RESISTOR, FIXED, COMPOSITION: 33, 000 ohms, ±10%, 1/2 w	745-1415-00
A2R29	RESISTOR, FIXED, COMPOSITION: same as A2R4	745-3384-00
A2R30	RESISTOR, FIXED, COMPOSITION: same as A2R9	745-0422-00
A2R31	RESISTOR, FIXED, COMPOSITION: same as A2R3	745-0317-00
A2T1	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0264-00
A2T2	TRANSFORMER, AUDIO FREQUENCY: 64, 000 ohms, 1 ma primary; 200 ohms secondary center tapped; 2 mw, 200 to 3500 cps at 2.5 db	677-1007-00
A2T3	TRANSFORMER, AUDIO FREQUENCY: 2000 ohms center tapped, 20 ma primary; 150 ohms each secondary; 350 mw; 200 to 3500 cps at 2 db	677-1008-00
A2T4	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0265-00
A2V1	ELECTRON TUBE: pentode; type 5899	255-0308-00
A2V2	ELECTRON TUBE: same as A2V1	255-0308-00
A2V3	ELECTRON TUBE: subminiature pentode; type 5636	255-0324-00
A2V4	ELECTRON TUBE: same as A2V1	255-0308-00
	USB I-F AMPLIFIER (Module A3)	543-0275-005
A3C1	CAPACITOR, FIXED, PAPER: 10, 000 uuf, ±20%, 100 v dc	931-4481-00
A3C2	CAPACITOR, FIXED, PAPER: 15, 000 uuf, ±20%, 100 v dc	931-5641-00
A3C3	CAPACITOR, FIXED, PAPER: 100, 000 uuf, ±20%, 200 v dc	931-5892-00
A3C4	CAPACITOR, FIXED, PAPER: 33, 000 uuf, ±20%, 200 v dc	931-5893-00
A3C5	CAPACITOR, FIXED, MICA: 180 uuf, ±2%, 500 v dc	912-1850-00
A3C6	CAPACITOR, FIXED, PAPER: same as A3C1	931-4481-00
A3C7	CAPACITOR, FIXED, PAPER: same as A3C2	931-5641-00
A3C8	CAPACITOR, FIXED, MICA: 91 uuf, ±2%, 500 v dc	912-1829-00
A3C9	CAPACITOR, FIXED, PAPER: same as A3C3	931-5892-00
A3C10	CAPACITOR, FIXED, PAPER: same as A3C4	931-5893-00
A3C11	CAPACITOR, FIXED, MICA: 510 uf, ±2%, 300 v dc	912-1883-00
A3C12	CAPACITOR, FIXED, PAPER: same as A3C1	931-4481-00
A3C13	CAPACITOR, FIXED, PAPER: same as A3C3	931-5892-00
A3C14	CAPACITOR, FIXED, MICA: same as A3C11	912-1883-00
A3C15	CAPACITOR, FIXED, PAPER: 2200 uuf, ±20%, 600 v dc	913-4564-00
A3C16	CAPACITOR, FIXED, ELECTROLYTIC: 4 uf, +75% -15%, 150 v dc	184-7043-00
A3C17	CAPACITOR, FIXED, PAPER: 33, 000 uuf, ±20%, 200 v dc	931-5941-00
A3C18	CAPACITOR, FIXED, PAPER: 4700 uuf, ±20%, 300 v dc	931-4522-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A3C19	CAPACITOR, FIXED, MICA: same as A3C11	912-1883-00
A3C20	CAPACITOR, FIXED, ELECTROLYTIC: 18 uf, +75% -15%, 50 v dc	184-7036-00
A3C21	CAPACITOR, FIXED, ELECTROLYTIC: 60 uf, ±20%, 6 v dc	184-7370-00
A3C22	CAPACITOR, FIXED, ELECTROLYTIC: same as A3C21	184-7370-00
A3C23	CAPACITOR, FIXED, ELECTROLYTIC: 220, 000 uuf, ±20%, 20 v dc	184-7376-00
A3C24	CAPACITOR, FIXED, ELECTROLYTIC: 2.2 uf, ±20%, 20 v dc	184-7377-00
A3C25	CAPACITOR, FIXED, MICA: 330 uuf, ±2%, 500 v dc	912-1868-00
A3C26	CAPACITOR, FIXED, PAPER: same as A3C3	931-5892-00
A3C27	CAPACITOR, FIXED, MICA: 300 uuf, ±2%, 500 v dc	912-1865-00
A3C28	CAPACITOR, FIXED, PAPER: same as A3C4	931-5893-00
A3C29	CAPACITOR, FIXED, PAPER: same as A3C3	931-5892-00
A3CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type 1N457	353-0204-00
A3CR2	SEMICONDUCTOR DEVICE, DIODE: same as A3CR1	353-0204-00
A3E1	SHIELD, ELECTRON TUBE: accommodates tube envelope style T-9	141-0223-00
A3E2 thru A3E4	SHIELD, ELECTRON TUBE: aluminum; 0.465 in. id, 0.495 in. od, 1-7/16 in. lg; incl insert	542-4782-002
A3FL1	FILTER, BAND PASS: 300 kc; 2.6 kc bandwidth at 25 db, 7.5 kc bandwidth at 60 db; 35, 000 ohms input, 14, 000 ohms output upper	526-9311-00
A3J1	JACK, TIP: standard phone tip accommodated; teflon insulation	360-0129-00
A3J2	JACK, TIP: same as A3J1	360-0129-00
A3L1	COIL, RADIO FREQUENCY: copper magnet wire; 3 to 5 mh	278-0266-00
A3L2	COIL, RADIO FREQUENCY: copper magnet wire; 25 mh	278-0267-00
A3P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts; 5 amps; straight	371-0020-00
A3Q1	TRANSISTOR: silicon; Bogue Electric part no. 2N161	352-0076-00
A3Q2	TRANSISTOR: silicon; Texas Instruments Co. type no. 2N243	352-0042-00
A3Q3	TRANSISTOR: same as A3Q2	352-0042-00
A3R1	RESISTOR, VARIABLE, WIREWOUND: 1000 ohms, ±10%, 0.4 w	381-1111-00
A3R2	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms, ±10%, 1/4 w	745-0408-00
A3R3	RESISTOR, FIXED, COMPOSITION: 150 ohms, ±10%, 1/4 w	745-0317-00
A3R4	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1 w	745-3384-00
A3R5	RESISTOR, FIXED, COMPOSITION: same as A3R2	745-0408-00
A3R6	RESISTOR, FIXED, COMPOSITION: same as A3R3	745-0317-00
A3R7	RESISTOR, FIXED, COMPOSITION: same as A3R4	745-3384-00
A3R8	NOT USED	
A3R9	RESISTOR, FIXED, COMPOSITION: 47, 000 ohms, ±10%, 1/4 w	745-0422-00
A3R10	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms, ±10%, 1/4 w	745-0436-00
A3R11	NOT USED	
A3R12	RESISTOR, FIXED, COMPOSITION: 330 ohms, ±10%, 1/4 w	745-0331-00
A3R13	RESISTOR, FIXED, COMPOSITION: 47, 000 ohms, ±10%, 1/2 w	745-1422-00
A3R14	RESISTOR, FIXED, COMPOSITION: 15, 000 ohms, ±10%, 1 w	745-3401-00
A3R15	RESISTOR, FIXED, COMPOSITION: 180, 000 ohms, ±10%, 1/4 w	745-0447-00
A3R16	RESISTOR, FIXED, COMPOSITION: 150, 000 ohms, ±10%, 1/4 w	745-0443-00
A3R17	RESISTOR, FIXED, COMPOSITION: 6800 ohms, ±10%, 1/4 w	745-0387-00
A3R18	NOT USED	
A3R19	RESISTOR, FIXED, COMPOSITION: 2000 ohms, ±5%, 1 w	745-3364-00
A3R20	RESISTOR, FIXED, COMPOSITION: 390 ohms, ±10%, 2 w	745-5635-00
A3R21	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%, 1/2 w	745-1310-00
A3R22	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±10%, 1/2 w	745-1282-00
A3R23	RESISTOR, FIXED, COMPOSITION: same as A3R22	745-1282-00
A3R24	RESISTOR, FIXED, COMPOSITION: 39, 000 ohms, ±10%, 1/4 w	745-0419-00
A3R25	RESISTOR, FIXED, COMPOSITION: 0.33 megohms, ±10%, 1/4 w	745-0457-00
A3R26	RESISTOR, FIXED, COMPOSITION: 1.0 megohm, ±10%, 1/4 w	745-0478-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A3R27	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms, ±10%, 1/4 w	745-0394-00
A3R28	RESISTOR, FIXED, COMPOSITION: 33, 000 ohms, ±10%, 1/2 w	745-1415-00
A3R29	RESISTOR, FIXED, COMPOSITION: same as A3R4	745-3384-00
A3R30	RESISTOR, FIXED, COMPOSITION: same as A3R9	745-0422-00
A3R31	RESISTOR, FIXED, COMPOSITION: same as A3R3	745-0317-00
A3T1	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0264-00
A3T2	TRANSFORMER, AUDIO FREQUENCY: 64, 000 ohms, 1 ma primary; 200 ohms secondary center tapped; 2 mw, 200 to 3500 cps at 2.5 db	677-1007-00
A3T3	TRANSFORMER, AUDIO FREQUENCY: 2000 ohms center tapped, 20 ma primary; 150 ohms each secondary; 350 mw; 200 to 3500 cps at 2 db	677-1008-00
A3T4	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0265-00
A3V1	ELECTRON TUBE: pentode; type 5899	255-0308-00
A3V2	ELECTRON TUBE: same as A3V1	255-0308-00
A3V3	ELECTRON TUBE: subminiature pentode; type 5636	255-0324-00
A3V4	ELECTRON TUBE: same as A3V1	255-0308-00
	AM I-F AMPLIFIER (Module A4)	543-0276-005
A4C1	CAPACITOR, FIXED, PAPER: 15, 000 uuf, ±20%, 100 v dc	931-5641-00
A4C2	CAPACITOR, FIXED, PAPER: 100, 000 uuf, ±20%, 200 v dc	931-5892-00
A4C3	CAPACITOR, FIXED, PAPER: 33, 000 uuf, ±20%, 200 v dc	931-5893-00
A4C4	CAPACITOR, FIXED, PAPER: 10, 000 uuf, ±20%, 100 v dc	931-4481-00
A4C5	CAPACITOR, FIXED, MICA: 180 uuf, ±2%, 500 v dc	912-1850-00
A4C6	CAPACITOR, FIXED, MICA: 91 uuf, ±2%, 500 v dc	912-1829-00
A4C7	CAPACITOR, FIXED, PAPER: same as A4C1	931-5641-00
A4C8	CAPACITOR, FIXED, PAPER: same as A4C2	931-5892-00
A4C9	CAPACITOR, FIXED, PAPER: same as A4C3	931-5893-00
A4C10	CAPACITOR, FIXED, MICA: 510 uuf, ±2%, 300 v dc	912-1883-00
A4C11	CAPACITOR, FIXED, PAPER: same as A4C2	931-5892-00
A4C12	CAPACITOR, FIXED, PAPER: same as A4C3	931-5893-00
A4C13	CAPACITOR, FIXED, MICA: same as A4C10	912-1883-00
A4C14	CAPACITOR, FIXED, MICA: 330 uuf, ±2%, 500 v dc	912-1868-00
A4C15	NOT USED	
A4C16	CAPACITOR, FIXED, PAPER: 4700 uuf, ±20%, 300 v dc	931-4522-00
A4C17	CAPACITOR, FIXED, MICA: same as A4C10	912-1883-00
A4C18	CAPACITOR, FIXED, ELECTROLYTIC: 60 uf, ±20%, 6 v dc	184-7370-00
A4C19	CAPACITOR, FIXED, ELECTROLYTIC: same as A4C18	184-7370-00
A4C20	CAPACITOR, FIXED, ELECTROLYTIC: 18 uf, +75% -15%, 50 v dc	184-7036-00
A4C21	CAPACITOR, FIXED, PAPER: same as A4C2	931-5892-00
A4C22	CAPACITOR, FIXED, MICA: same as A4C14	912-1868-00
A4C23	CAPACITOR, FIXED, PAPER: same as A4C2	931-5892-00
A4C24	CAPACITOR, FIXED, MICA: 300 uuf, ±2%, 500 v dc	912-1865-00
A4C25	CAPACITOR, FIXED, PAPER: same as A4C3	931-5893-00
A4C26	CAPACITOR, FIXED, PAPER: Same as A4C2	931-5892-00
A4C27	CAPACITOR, FIXED, PAPER: same as A4C4	931-4481-00
A4CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hughes Aircraft Co. type 1N457	353-0204-00
A4CR2	SEMICONDUCTOR DEVICE, DIODE: same as A4CR1	353-0204-00
A4CR3	SEMICONDUCTOR DEVICE, DIODE: same as A4CR1	353-0204-00
A4E1	SHIELD, ELECTRON TUBE: accommodates tube envelope style T-9	141-0223-00
A4E2	SHIELD, ELECTRON TUBE: aluminum; 0.465 in. id, 0.495 in. od, 1-7/16 in. lg; incl insert	542-4782-002
A4E3	SHIELD, ELECTRON TUBE: same as A4E2	542-4782-002
A4E4	SHIELD, ELECTRON TUBE: same as A4E2	542-4782-002
A4FL1	FILTER, BAND PASS: 300 kc; 6.0 kc bandwidth at 2.5 db, 13.2 kc bandwidth at 60 db; 35, 000 ohms input, 14, 000 ohms output	526-9307-00
A4J1	JACK, TIP: std phone tip accommodated; teflon insulation	360-0129-00
A4J2	JACK, TIP: same as A4J1	360-0129-00
A4L1	COIL, RADIO FREQUENCY: copper magnet wire; 3 to 5 mh	278-0266-00
A4P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 rd male contacts, 5 amps; straight	371-0020-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A4Q1	TRANSISTOR: silicon; Bogue Electric part no. 2N161	352-0076-00
A4Q2	TRANSISTOR: silicon; Texas Instruments type no. 2N243	352-0042-00
A4Q3	TRANSISTOR: same as A4Q2	352-0042-00
A4R1	RESISTOR, VARIABLE, WIREWOUND: 1000 ohms, ±10%, 0.4 w	381-1111-00
A4R2	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms, ±10%, 1/4 w	745-0408-00
A4R3	RESISTOR, FIXED, COMPOSITION: 150 ohms, ±10%, 1/4 w	745-0317-00
A4R4	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1 w	745-3384-00
A4R5	RESISTOR, FIXED, COMPOSITION: same as A4R2	745-0408-00
A4R6	RESISTOR, FIXED, COMPOSITION: same as A4R3	745-0317-00
A4R7	RESISTOR, FIXED, COMPOSITION: same as A4R4	745-3384-00
A4R8	RESISTOR, FIXED, COMPOSITION: 27, 000 ohms, ±10%, 1/4 w	745-0412-00
A4R9	RESISTOR, FIXED, COMPOSITION: same as A4R3	745-0317-00
A4R10	RESISTOR, FIXED, COMPOSITION: same as A4R4	745-3384-00
A4R11	RESISTOR, FIXED, COMPOSITION: 68, 000 ohms, ±10%, 1/4 w	745-0429-00
A4R12	RESISTOR, FIXED, COMPOSITION: 18, 000 ohms, ±10%, 1/4 w	745-0405-00
A4R13	RESISTOR, FIXED, COMPOSITION: 39, 000 ohms, ±10%, 1/4 w	745-0419-00
A4R14	RESISTOR, FIXED, COMPOSITION: 180, 000 ohms, ±10%, 1/4 w	745-0447-00
A4R15	RESISTOR, FIXED, COMPOSITION: 150, 000 ohms, ±10%, 1/4 w	745-0443-00
A4R16	RESISTOR, FIXED, COMPOSITION: 6800 ohms, ±10%, 1/4 w	745-0387-00
A4R17	NOT USED	
A4R18	RESISTOR, FIXED, COMPOSITION: 2000 ohms, ±5%, 1 w	745-3364-00
A4R19	RESISTOR, FIXED, COMPOSITION: 390 ohms, ±10%, 2 w	745-5635-00
A4R20	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%, 1/2 w	745-1310-00
A4R21	RESISTOR, FIXED, COMPOSITION: 22 ohms, ±10%, 1/2 w	745-1282-00
A4R22	RESISTOR, FIXED, COMPOSITION: same as A4R21	745-1282-00
A4R23	RESISTOR, FIXED, COMPOSITION: same as A4R13	745-0419-00
A4R24	RESISTOR, FIXED, COMPOSITION: 330, 000 ohms, ±10%, 1/4 w	745-0457-00
A4R25	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms ±10%, 1/4 w	745-0394-00
A4R26	RESISTOR, FIXED, COMPOSITION: same as A4R25	745-0394-00
A4R27	RESISTOR, FIXED, COMPOSITION: 39, 000 ohms, ±10%, 1 w	745-3419-00
A4R28	RESISTOR, FIXED, COMPOSITION: same as A4R4	745-3384-00
A4R29	RESISTOR, FIXED, COMPOSITION: same as A4R11	745-0429-00
A4R30	RESISTOR, FIXED, COMPOSITION: same as A4R3	745-0317-00
A4T1	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0264-00
A4T2	TRANSFORMER, INTERMEDIATE FREQUENCY: same as A4T1	278-0264-00
A4T3	TRANSFORMER, AUDIO FREQUENCY: 64, 000 ohms, 1 ma primary; 200 ohms secondary center tapped; 2 mw; 200 to 3500 cps at 2.5 db	677-1007-00
A4T4	TRANSFORMER, AUDIO FREQUENCY: 2000 ohms center tapped, 20 ma primary; 150 ohms each secondary; 350 mw; 200 to 3500 cps at 2 db	677-1008-00
A4T5	TRANSFORMER, INTERMEDIATE FREQUENCY: interstage; 290 to 310 kc	278-0265-00
A4V1 thru A4V4	ELECTRON TUBE: pentode; type 5899	255-0308-00
	CARRIER GENERATOR (Module A5)	543-1500-004
A5C1	CAPACITOR, FIXED, MICA: 510 uuf, ±5%, 300 v dc	912-1884-00
A5C2	CAPACITOR, FIXED, PAPER: 0.033 uf, ±20%, 200 v dc	931-4504-00
A5C3	CAPACITOR, FIXED, MICA: 270 uuf, ±1%, 300 v dc	912-2679-00
A5C4	CAPACITOR, FIXED, MICA: 3500 uuf, ±2%, 500 v dc	912-1934-00
A5C5	CAPACITOR, VARIABLE, GLASS: 1 to 20 uuf, 500 v dc	922-0480-00
A5C6	CAPACITOR, FIXED, PAPER: 0.047 uf, ±20%, 100 v dc	931-4486-00
A5C7	CAPACITOR, FIXED, PAPER: same as A5C6	931-4486-00
A5C8	CAPACITOR, FIXED, MICA: 39 uuf, ±5%, 500 v dc	912-1803-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A5C9	CAPACITOR, FIXED, MICA: same as A5C1	912-1884-00
A5C10	CAPACITOR, FIXED, ELECTROLYTIC: 2 uf, +75%, -15%, 65 v dc	184-7278-00
A5C11	CAPACITOR, FIXED, MICA: 150 uuf, ±5%, 500 v dc	912-1845-00
A5C12	CAPACITOR, FIXED, MICA: same as A5C11	912-1845-00
A5C13	CAPACITOR, FIXED, PAPER: same as A5C2	931-4504-00
A5C14	CAPACITOR, FIXED, PAPER: same as A5C2	931-4504-00
A5C15	CAPACITOR, FIXED, MICA: 100 uuf, ±5%, 500 v dc	912-1833-00
A5C16	CAPACITOR, FIXED, MICA: same as A5C2	931-4504-00
A5C17	CAPACITOR, FIXED, MICA: same as A5C2	931-4504-00
A5C18	CAPACITOR, FIXED, CERAMIC: 50, 000 uuf, ±20%, 100 v dc	913-3023-00
A5CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; type 1N457	353-0204-00
A5H1	WASHER, SPRING TENSION: beryllium copper, 0.005 in. thk, 0.137 in. id, 5/16 in. od	543-1834-002
A5H2	SCREW, EXTERNALLY RELIEVED BODY: stainless steel; 8-32 thd; 4.6245 in. lg	542-7683-002
A5J1	JACK, TIP: std phone tip, female contact, 5 amps, 1250 v rms, 60 cps; incl holder	543-1838-002
A5J2	JACK, TIP: same as A5J1	543-1838-002
A5J3	JACK, TIP: same as A5J1	543-1838-002
A5L1	COIL, RADIO FREQUENCY: toroidal wound, 1 mh inductance	240-0595-00
A5L2	COIL, RADIO FREQUENCY: universal wound, no. 32 AWG, 30 uh, 0.7 ohms, 300 ma	240-0605-00
A5L3	COIL, RADIO FREQUENCY: universal wound pi sections, 20 ma current; 1.0 mh	240-0602-00
A5L4	COIL, RADIO FREQUENCY: toroidal wound, 40 turns no. 32 AWG wire; 1.0 mh at 300 kc; w/ metal insert and compound covered	543-1847-003
A5L5	COIL, RADIO FREQUENCY: universal wound pi sections, 20 ma, 3.0 mh	240-0603-00
A5L6	COIL, RADIO FREQUENCY: same as A5L5	240-0603-00
A5R1	RESISTOR, FIXED, COMPOSITION: 1.0 megohms, ±10%, 1/2 w	745-1478-00
A5R2	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms, ±5%, 1/2 w	745-1393-00
A5R2	RESISTOR, FIXED, COMPOSITION: 11, 000 ohms, ±5%, 1/2 w	745-1396-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
A5R2	RESISTOR, FIXED, COMPOSITION: 12, 000 ohms, ±5%, 1/2 w	745-1397-00
A5R2	RESISTOR, FIXED, COMPOSITION: 13, 000 ohms, ±5%, 1/2 w	745-1399-00
A5R2	RESISTOR, FIXED, COMPOSITION: 15, 000 ohms, ±5%, 1/2 w	745-1400-00
A5R2	RESISTOR, FIXED, COMPOSITION: 16, 000 ohms, ±5%, 1/2 w	745-1403-00
A5R2	RESISTOR, FIXED, COMPOSITION: 18, 000 ohms, ±5%, 1/2 w	745-1404-00
A5R2	RESISTOR, FIXED, COMPOSITION: 20, 000 ohms, ±5%, 1/2 w	745-1406-00
A5R2	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms, ±5%, 1/2 w	745-1407-00
A5R2	RESISTOR, FIXED, COMPOSITION: 24, 000 ohms, ±5%, 1/2 w	745-1410-00
A5R2	RESISTOR, FIXED, COMPOSITION: 27, 000 ohms, ±5%, 1/2 w	745-1411-00
A5R3	RESISTOR, FIXED, COMPOSITION: 820, 000 ohms, ±10%, 1/2 w	745-1475-00
A5R4	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms, ±10%, 1/2 w	745-1408-00
A5R5	RESISTOR, FIXED, COMPOSITION: 820 ohms, ±10%, 1/2 w	745-1349-00
A5R6	NOT USED	
A5R7	RESISTOR, FIXED, COMPOSITION: 15, 000 ohms, ±10%, 1/2 w	745-1401-00
A5R8	RESISTOR, FIXED, COMPOSITION: 47 ohms, ±10%, 1/2 w	745-1296-00
A5R9	NOT USED	
A5R10	RESISTOR, FIXED, COMPOSITION: same as A5R7	745-1401-00
A5R11	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1/2 w	745-1384-00
A5R12	RESISTOR, FIXED, COMPOSITION: 56, 000 ohms, ±10%, 1/2 w	745-1426-00
A5V1	ELECTRON TUBE: subminiature pentode; type 5840	255-0242-00
A5V2	ELECTRON TUBE: subminiature; twin triode; type 6021	255-0238-00
A5V3	ELECTRON TUBE: same as A5V1	255-0242-00

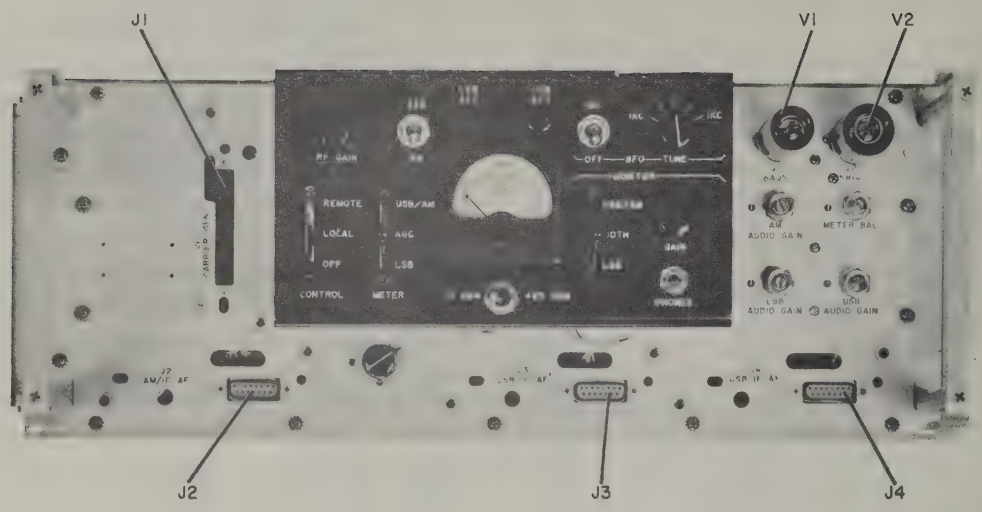


Figure 4-1. I-F Translator 786K-1, Front Chassis View, Modules Removed

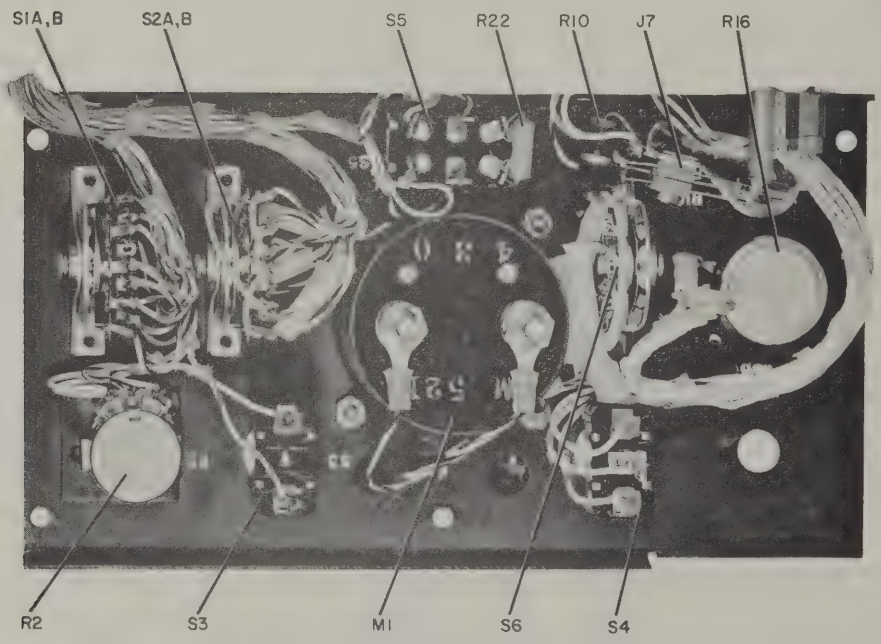


Figure 4-2. Control Panel, Rear View

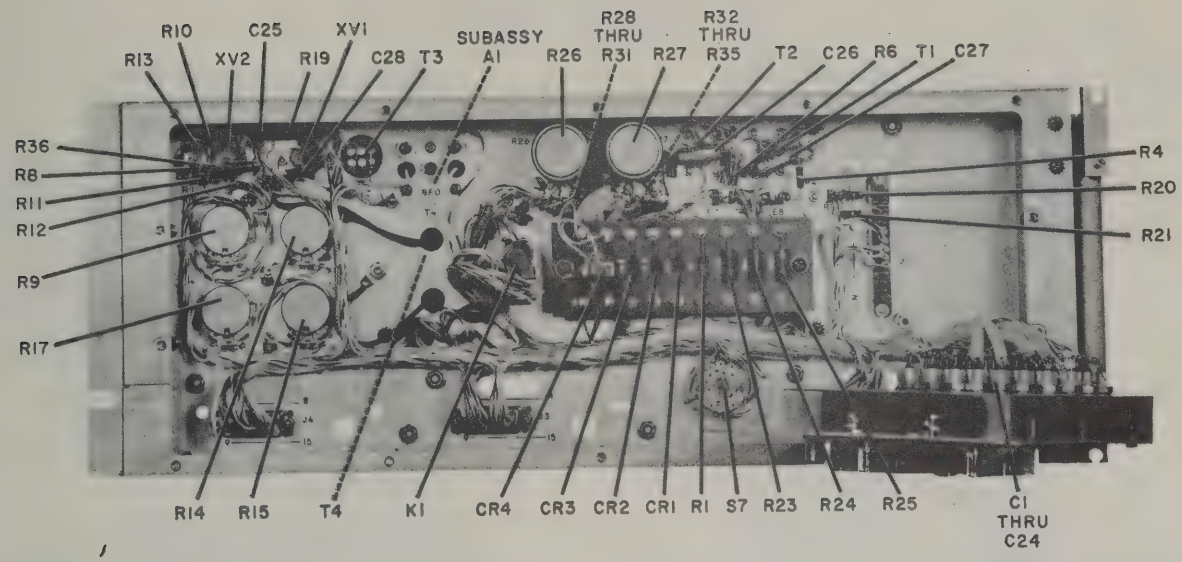


Figure 4-3. I-F Translator 786K-1, Rear View, Rear Panel Off, Filter Box Lowered

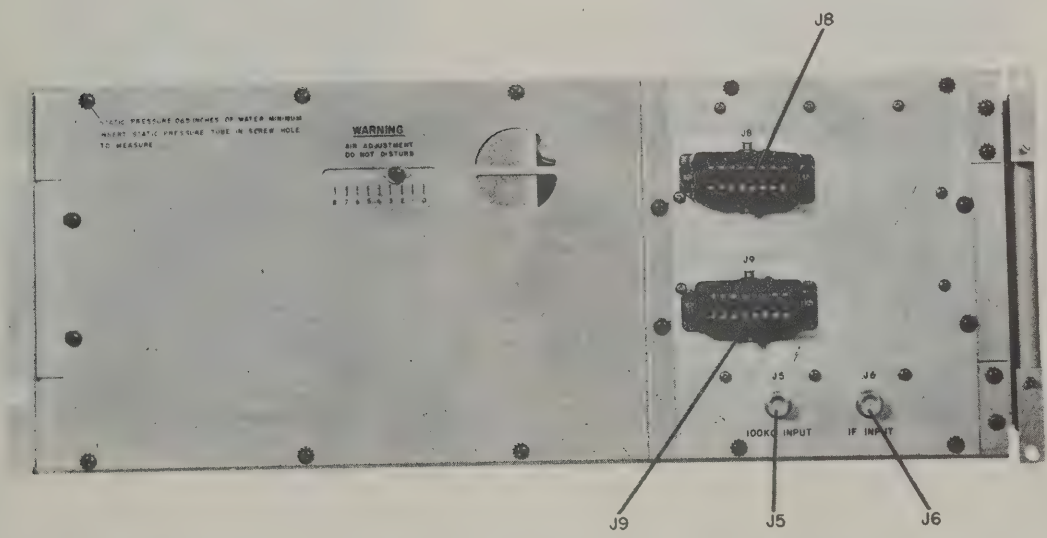


Figure 4-4. I-F Translator 786K-1, Rear View, Rear Panel and Filter Box in Place

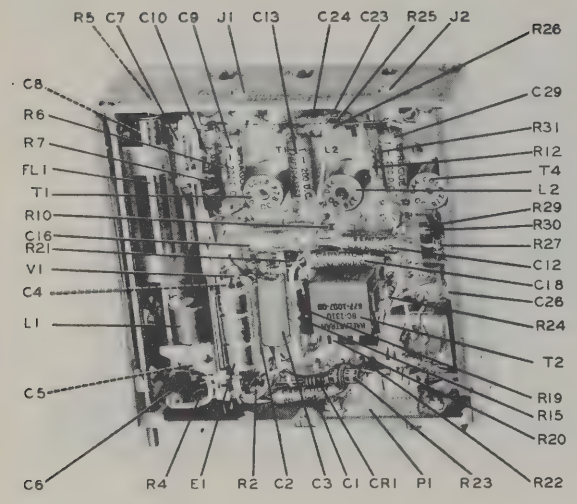


Figure 4-5. LSB I-F Amplifier Module and USB I-F Amplifier Module, Front View, Cover Removed

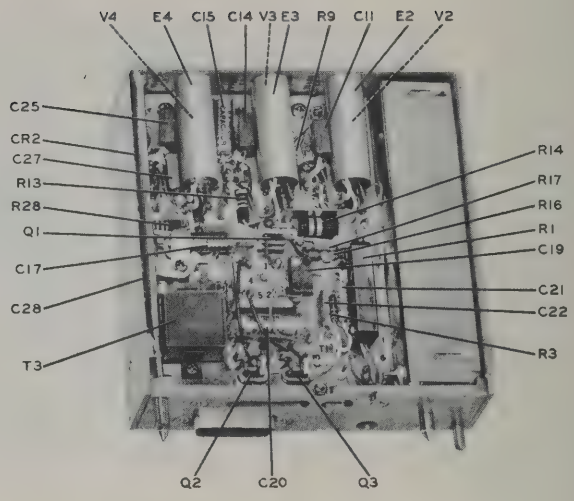


Figure 4-6. LSB I-F Amplifier Module and USB I-F Amplifier Module, Rear View, Cover Removed

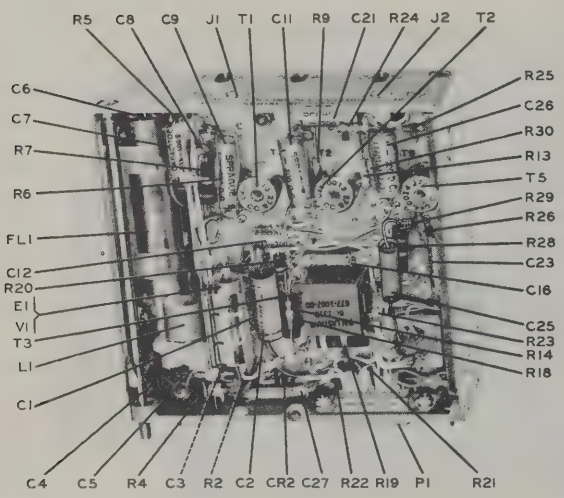


Figure 4-7. AM I-F Amplifier Module, Front View, Cover Removed

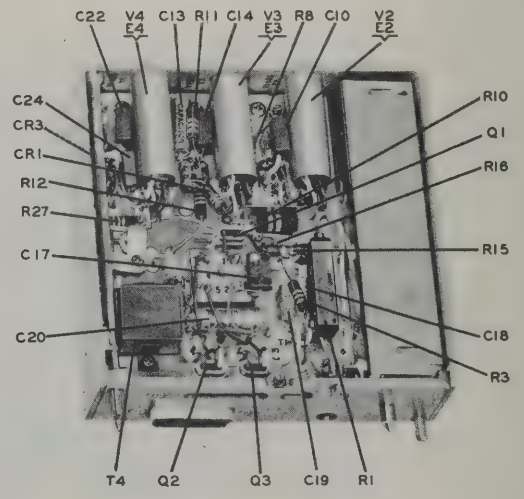


Figure 4-8. AM I-F Amplifier Module, Rear View, Cover Removed

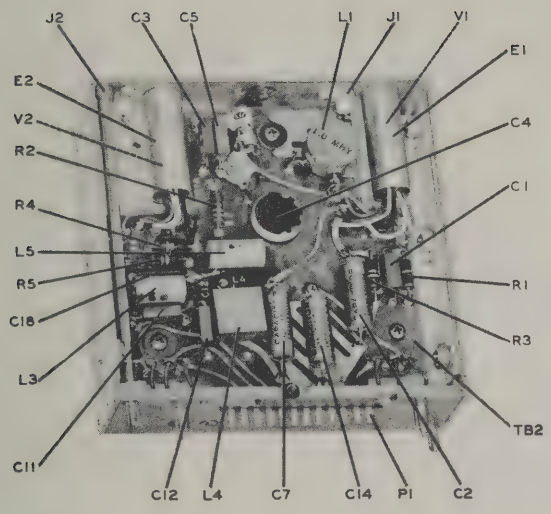


Figure 4-9. Carrier Generator Module, Front View, Cover Removed

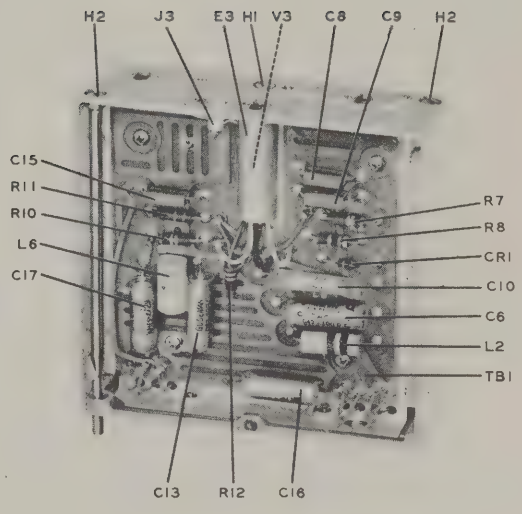
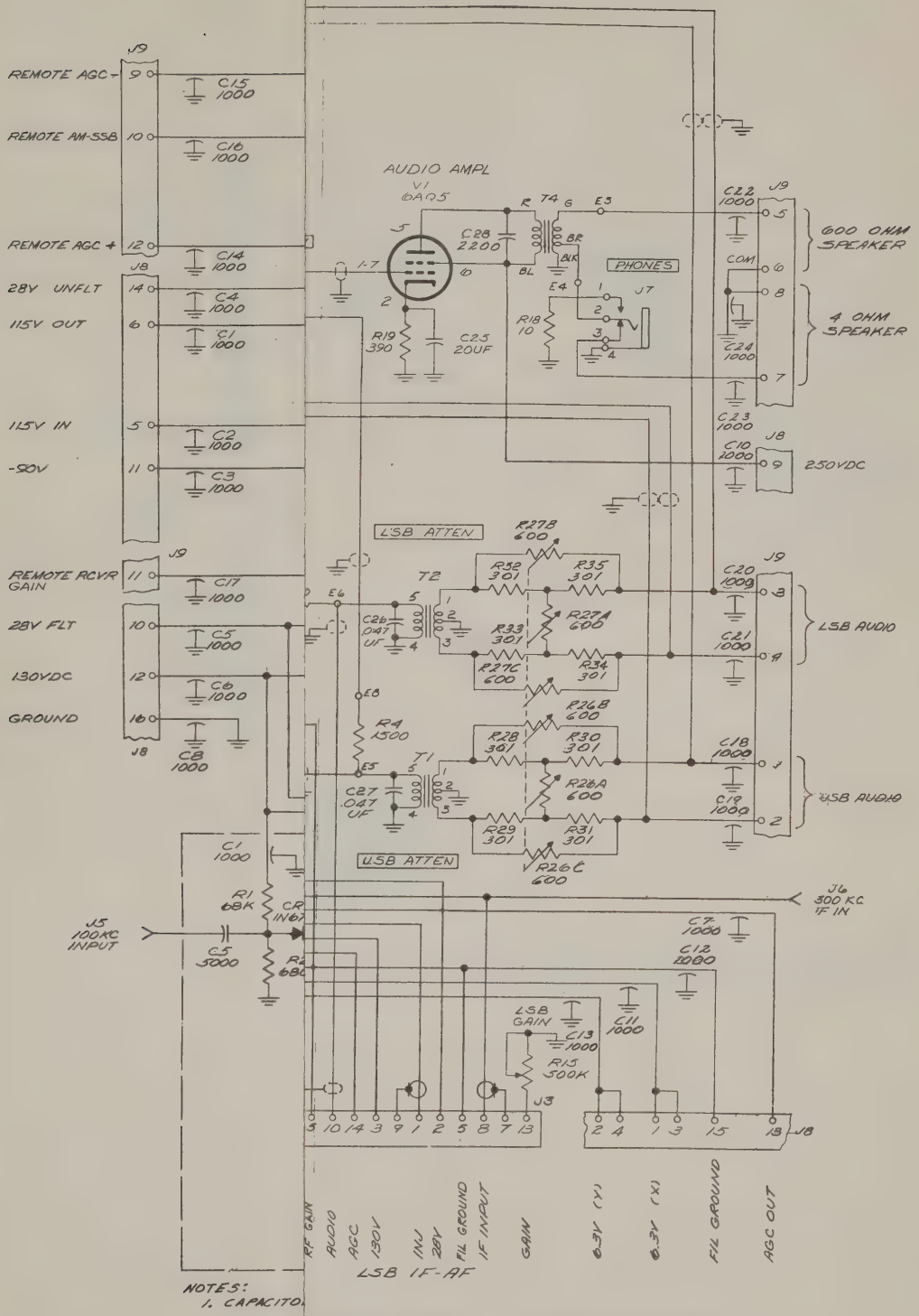


Figure 4-10. Carrier Generator Module, Rear View, Cover Removed

SECTION V
ILLUSTRATIONS



Translator 786K-1 Chassis, Schematic Diagram

SECTION V
ILLUSTRATIONS

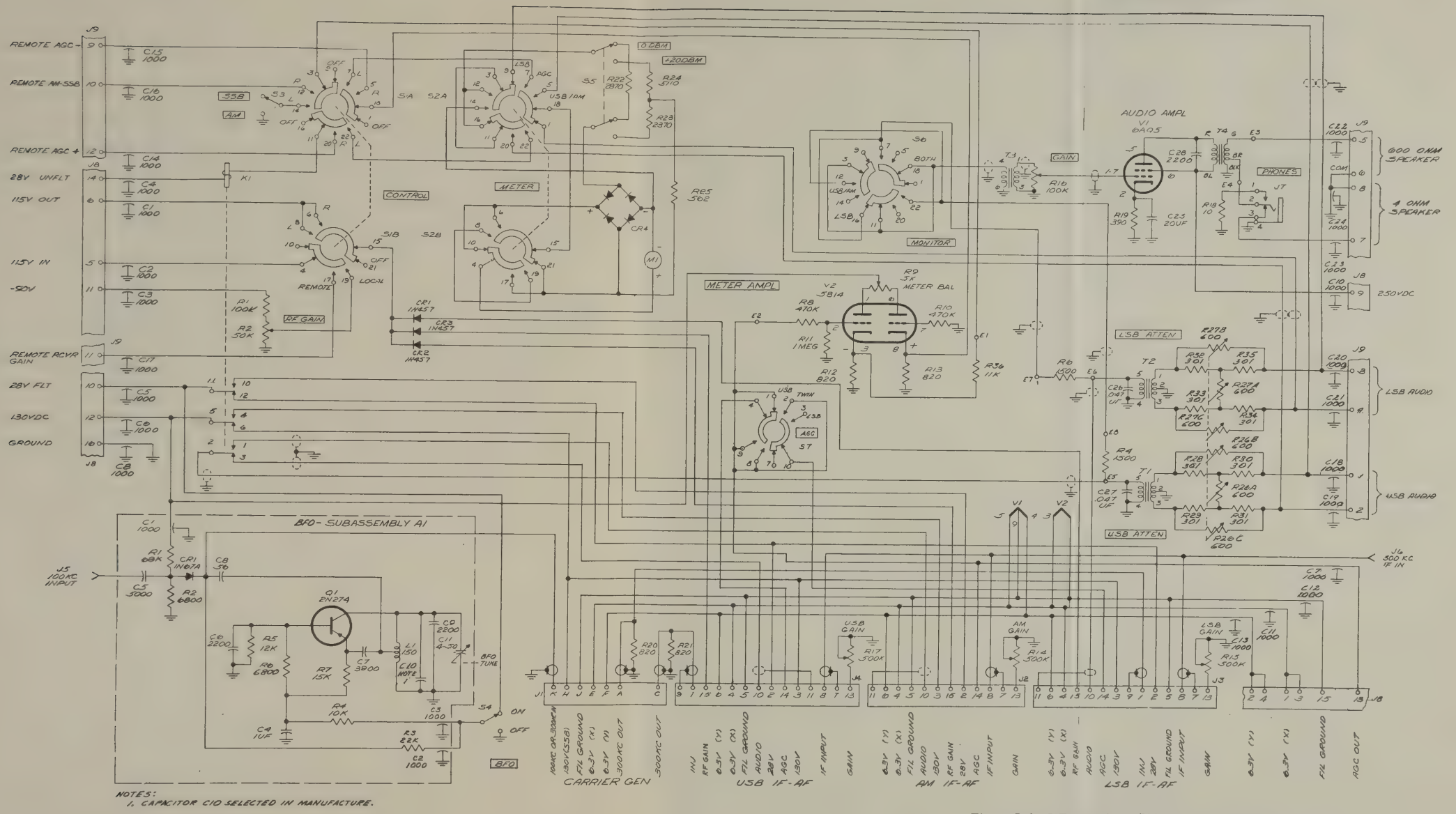
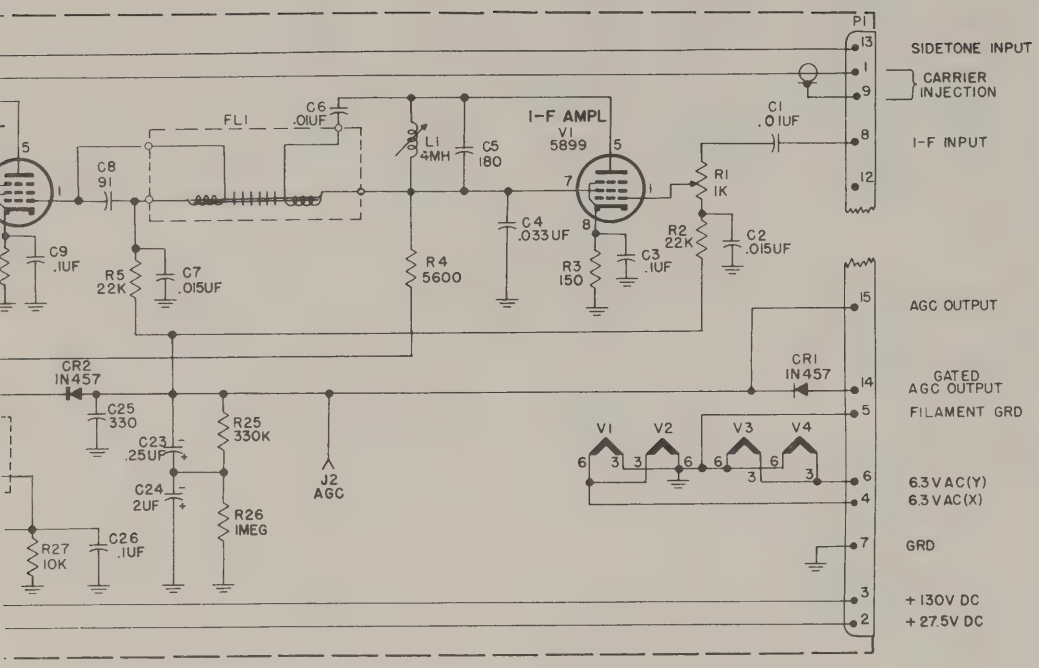


Figure 5-1. I-F Translator 786K-1 Chassis, Schematic Diagram


P1
13
1
9
8
12
15
14
5
6
4
7
3
2
SIDETONE INPUT
CARRIER INJECTION
I-F INPUT
AGC OUTPUT
GATED AGC OUTPUT
FILAMENT GRD
6.3 VAC(Y)
6.3 VAC(X)
GRD
+130V DC
+27.5V DC
I-F AMPL
V1
5899
C1 .01UF
C2 .015UF
C3 .1UF
C4 .033UF
C5 180
C6 .01UF
C7 .015UF
C8 91
C9 .1UF
C23 .25UF
C24 2UF
C25 330
C26 .1UF
R1 1K
R2 22K
R3 150
R4 5600
R5 22K
R25 330K
R26 1MEG
R27 10K
L1 4MH
FL1
CR1 IN457
CR2 IN457
J2 AGC
V1
V2
V3
V4

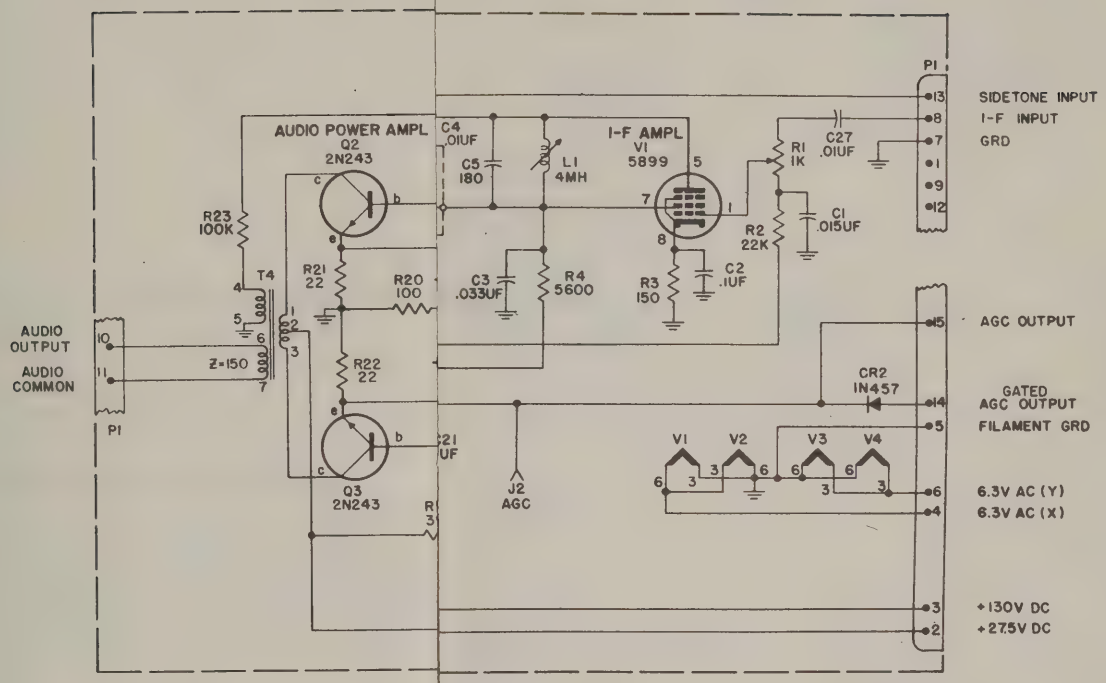
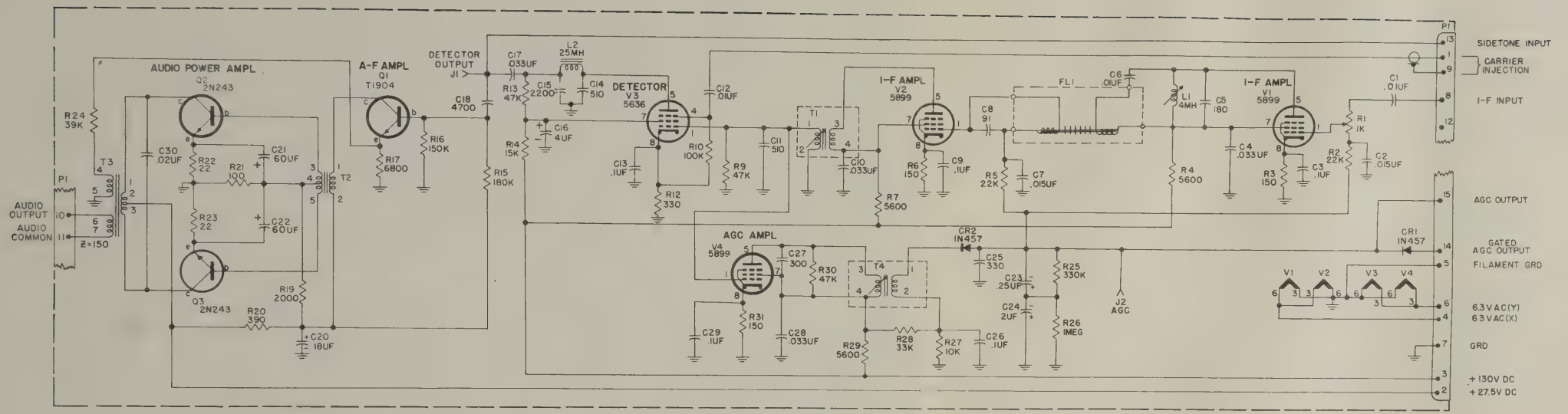


Figure 5-3. AM I-F Amplifier Module, Schematic Diagram



NOTES

1. UNLESS OTHERWISE INDICATED
   ALL RESISTANCE VALUES ARE IN OHMS,
   ALL CAPACITANCE VALUES ARE IN UUF
   ALL INDUCTANCE VALUES ARE IN UH.
2. REFERENCE DESIGNATION ARE ABBREVIATED.
   PREFIX DESIGNATION WITH UNIT NUMBER
   AND SUBASSEMBLY DESIGNATION
3. MOD A. C19-510 UUF DELETED; C30-.02UF ADDED.

Figure 5-2. LSB I-F Amplifier Module and USB I-F Amplifier Module, Schematic Diagram

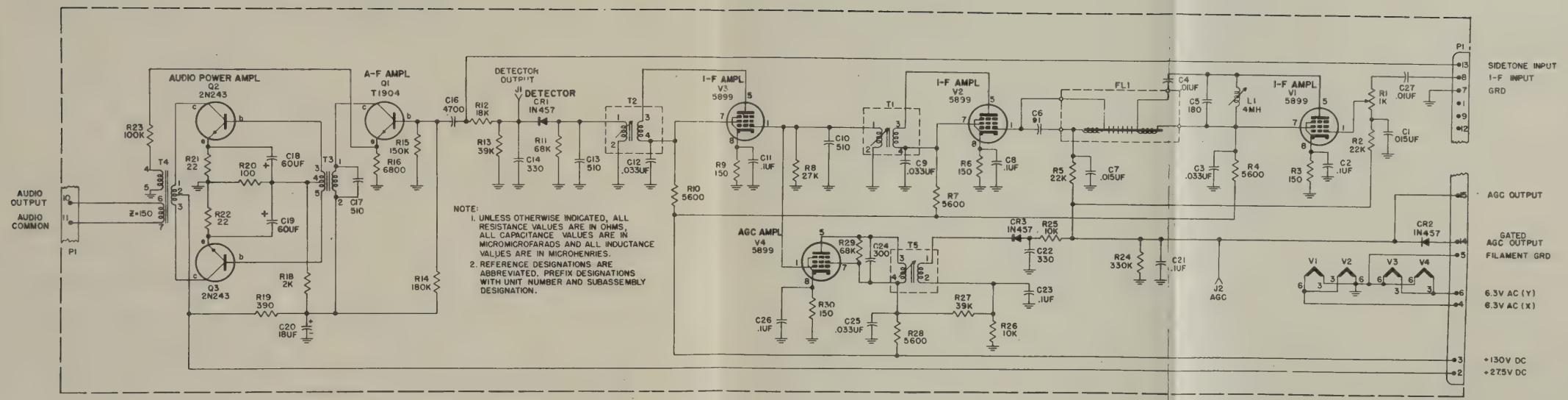


Figure 5-3. AM I-F Amplifier Module, Schematic Diagram

'ESISTANCE VALUES
IN UH.
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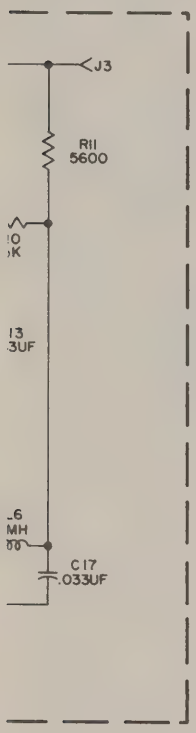
SSEMBLY DESIGNATION.
T.



UNIT INSTRUCTIONS

TD-523
1 MAY 1961

BLOWER 199M-1

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1961

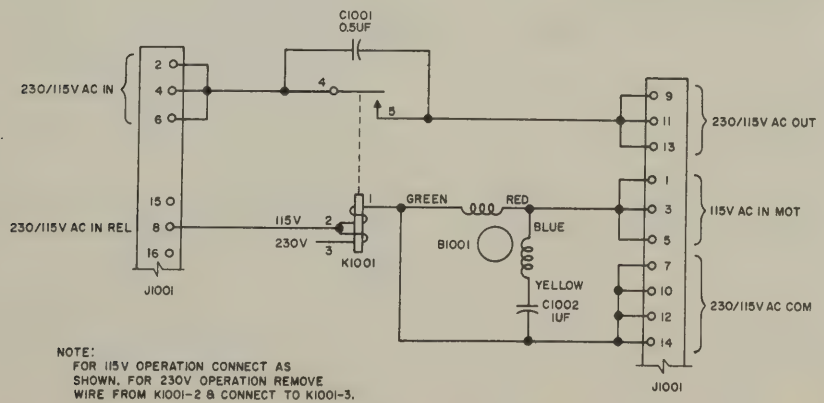
CEDAR RAPIDS, IOWA, U.S.A.

PRINTED IN THE UNITED STATES OF AMERICA

1.1 APPLICATION AND DESCRIPTION.

Blower 199M-1 is a centrifugal blower capable of delivering 68 cfm of free air. The blower is driven by a direct-coupled 115-volt single-phase induction motor. The air input to the blower is through an air filter located on the front panel of the unit. The 199M-1 includes an interlock relay which is actuated when the primary power is applied to the relay coil. The contacts of the interlock relay are used as interlocks in the primary power to the system.

Blower 199M-1 mounts in a standard 19-inch open-type relay rack. The air output is connected to the air



C726-01-3

Figure 1. Blower 199M-1, Schematic Diagram

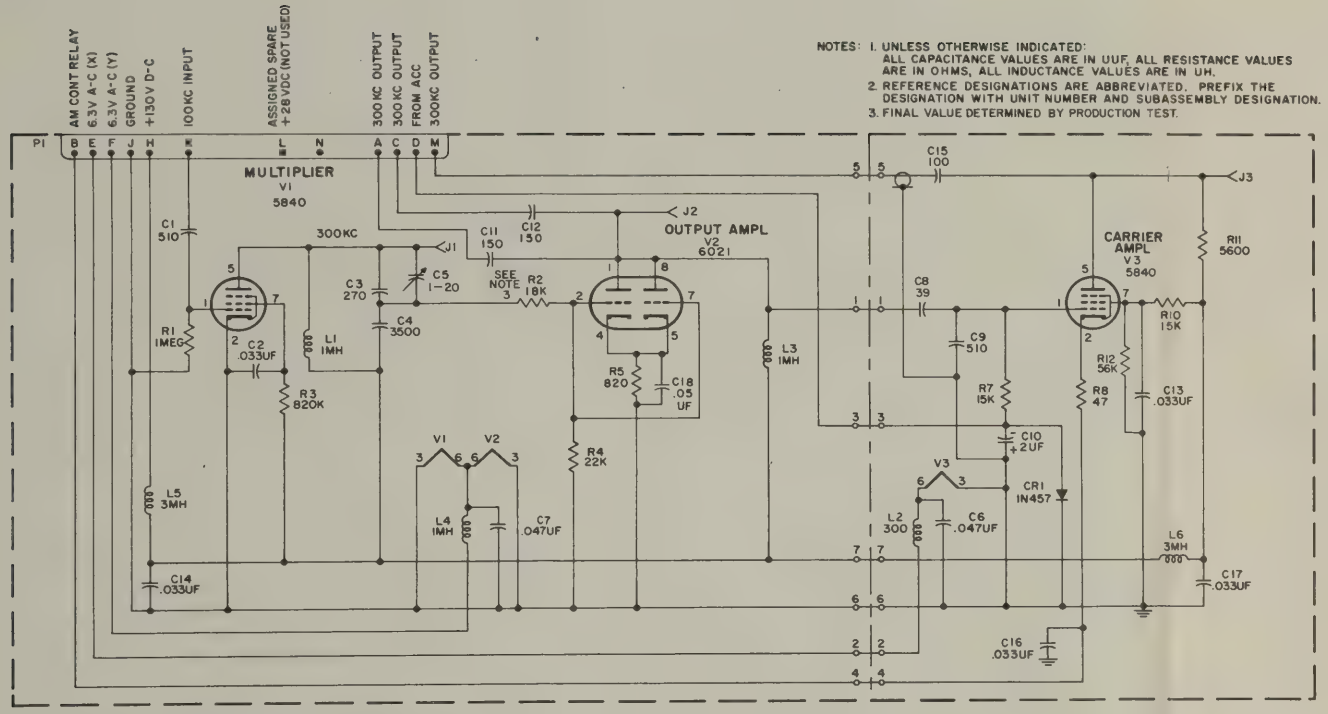


Figure 5-4. Carrier Generator Module, Schematic Diagram

BLOWER 199M-1

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1961

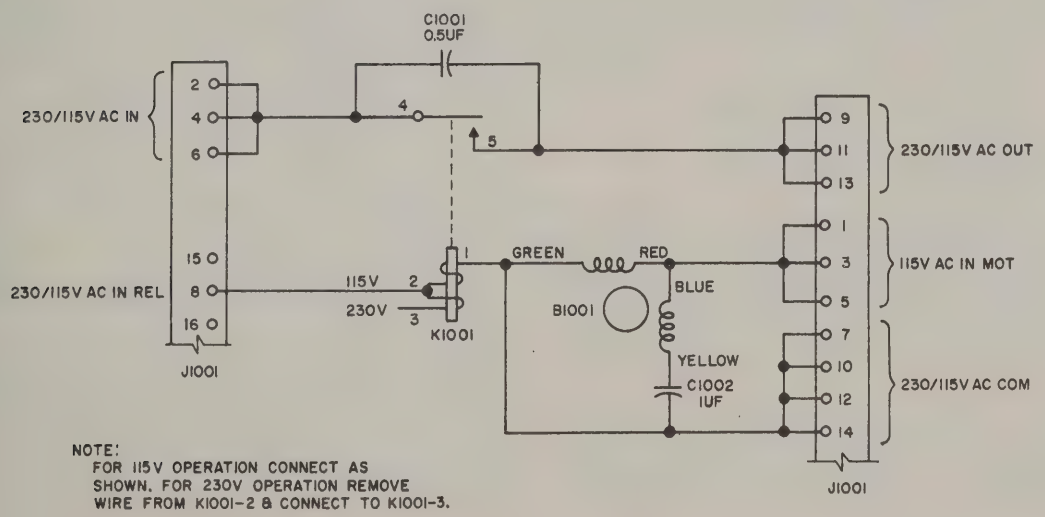
CEDAR RAPIDS, IOWA, U.S.A.

PRINTED IN THE UNITED STATES OF AMERICA

1.1 APPLICATION AND DESCRIPTION.

Blower 199M-1 is a centrifugal blower capable of delivering 68 cfm of free air. The blower is driven by a direct-coupled 115-volt single-phase induction motor. The air input to the blower is through an air filter located on the front panel of the unit. The 199M-1 includes an interlock relay which is actuated when the primary power is applied to the relay coil. The contacts of the interlock relay are used as interlocks in the primary power to the system.

Blower 199M-1 mounts in a standard 19-inch open-type relay rack. The air output is connected to the air



C726-01-3

Figure 1. Blower 199M-1, Schematic Diagram

duct of the rack for delivering to the units mounted on the rack. All power and control connections are made through a 16-pin connector located on the rear of the 199M-1. Access to components is obtained by removing the front cover and air filter.

1.2 TECHNICAL CHARACTERISTICS.

Voltage source . . . . 115/230 volts, 50-60 cps.

Power input . . . . . 40 watts.

Output capacity . . . . 68 cfm of free air.

Dimensions . . . . . 11-1/4 in. deep, 5-1/4 in. high, 19 in. wide.

Weight . . . . . 15 lb.

2.1 MAINTENANCE.

2.1.1 VOLTAGE CONVERSION.

Terminal connections on the interlock relay allow Blower 199M-1 to be operated on 115 or 230 volts. When operating from a 115-volt source, the wire from terminal 8 of J1001 should be connected to terminal 2 of the coil of interlock relay K1001. When operating from a 230-volt source, connect this wire to terminal 3 of interlock relay coil. See figure 1.

2.1.2 AIR FILTER CLEANING PROCEDURE.

Establish a regular cycle of cleaning the air filter based on visual inspection and experience. Always clean the filter before the air-outlet side becomes dirty. To clean the filter, gently immerse in cool water, dirty side up, to float out lint. A gentle up-and-down motion dislodges any stubborn particles. If a large amount of grease or oil has accumulated on the filter, use a mild detergent in the water. If it is impossible to immerse the filter, pass a fine spray of water through it in the direction opposite to that of air flow. Shake gently to remove water, and replace in equipment.

2.1.2 LUBRICATION.

The blower motor has sealed bearings which are lubricated for the life of the blower. No lubrication is required.

PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	BLOWER 199M-1	522-2444-00
B1001	BLOWER ASSEMBLY: centrifugal, inverted, direct coupled a-c, 40 w at 115 volts a-c, 60 cps at free air, 3000 rpm min, 115 volts a-c rms, 50-60 cps single phase, 0.370 amp, continuous duty cycle, double shielded ball bearings, stainless steel shaft, die-cast aluminum motor case	009-1360-00
C1001	CAPACITOR, FIXED, PAPER DIELECTRIC: tubular w/ wire leads; 300-volt d-c working; 470,000 uuf ±20%; uninsulated metal case, hermetically sealed; 0.670 in. dia by 1-5/8 in. lg; 1-R schematic	931-4538-00
C1002	CAPACITOR, FIXED, PAPER DIELECTRIC: 600-volt d-c working; 1.0 uuf ±10%; hermetically sealed metal case 7/8 in. by 1-3/4 in. by 2 in.; uninsulated	961-4417-00
E1001	TERMINAL STUD: brass terminal, glass filled diallyl phthalate insulation; brass, cadmium plated, 4-40 thd. mtg stud; 1/4 in. hex by 3/4 in. lg overall	306-0977-00
E1002	TERMINAL STUD: same as E1001	306-0977-00
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: 16 female contacts, 5 amp at 600 volts d-c	372-1265-00
K1001	RELAY ARMATURE: 1A contact arrangement, 15 amp at 120 volts a-c resistive; 7000 ohms coil resistance	970-2161-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
H1001	WASHER, LOCK: CRES; split helical ring; 0.115 in. id, 0.253 in. od, 0.031 in. thk	310-0279-00
H1002	WASHER, LOCK: CRES; split helical ring, 0.141 in. id, 0.253 in. od, 0.031 in. thk	310-0282-00
H1003	WASHER, FLAT: CRES; 0.147 in. id, 3/8 in. od, 0.031 in. thk	310-6360-00
H1004	NUT, PLAIN, HEXAGON: stainless steel; 6-32 thd 0.312 in. hex by 0.109 in. thk	313-0002-00
H1005	NUT, PLAIN, HEXAGON: CRES; 4-40 NC-2, 3/16 in. w across flats, 1/16 in. thk	313-0132-00
H1006	SCREW, MACHINE: CRES; Phillips flathead; 4-40 NC-2A thd; 3/16 in. lg	342-0043-00
H1007	SCREW, MACHINE: CRES; Phillips flathead; 4-40 NC-2A thd; 1/4 in. lg	342-0044-00
H1008	SCREW, MACHINE: stainless steel, Phillips recessed flathead, 6-32 NC-2A thd, 1 in. lg	342-0069-00
H1009	SCREW, MACHINE: CRES; Phillips panhead; 2-56 NC-2A, 1/8 in. lg	343-0122-00
H1010	SCREW, MACHINE: stainless steel; panhead; 4-40 NC-2A thd; 5/16 in. lg	343-0134-00
H1011	SCREW, MACHINE: CRES; panhead; 6-32 NC-2A thd; 5/16 in. lg	343-0168-00
MP1001	MOUNT, RESILIENT: synthetic rubber	200-0629-00
MP1002	MOUNT, RESILIENT: same as MP1001	200-0629-00
MP1003	MOUNT, RESILIENT: same as MP1001	200-0629-00
MP1004	MOUNT, RESILIENT: same as MP1001	200-0629-00

UNIT INSTRUCTIONS

TD-496
2nd EDITION, 1 NOVEMBER 1960

JUNCTION BOX 153H-3

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1960

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C220-99-P

Figure 1. Junction Box 153H-3

1.1 APPLICATION AND DESCRIPTION.

Junction Box 153H-3 is used for making interunit and external connections and will hold 16 of the standard 20-pin terminal blocks. In addition, it contains the thermal relay receiver input protector unit and fuses for the primary power of the system.

The thermal relay receiver input protector unit provides the receiver with protection from excessive currents entering the receiver antenna input. Excessive currents are those that are 100 milliamperes or greater. A coaxial relay, thermal relay, indicator lamp, and reset button are the protector components.

Junction Box 153H-3 is designed for mounting in a standard 19-inch, open-type rack requiring 3-1/2 inches of rack space. A metal dust cover, secured by fasteners, provides protection for

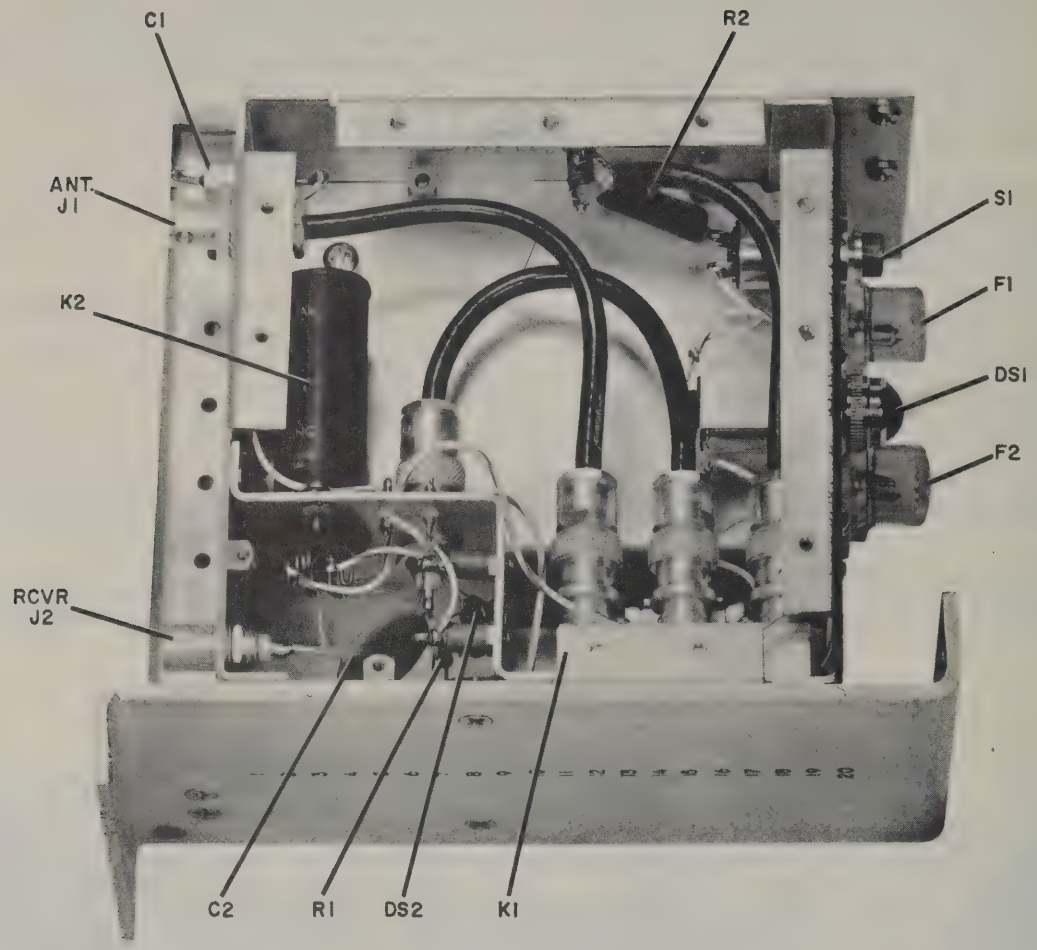


Figure 2. Thermal Relay Input Protector, Bottom View, Cover Removed

C718-02-P

the terminals and personnel. The fuse holders, reset button, and indicator lamp are accessible from the front of the junction box.

1.2 TECHNICAL CHARACTERISTICS.

Weight	7 pounds.
Dimensions	3-1/2 inches high, 19 inches wide, and 7 inches deep.
Power requirements	+28 volts d-c.
Signal input	Currents in excess of 100 milliamperes will operate thermal relay.
Required rack space	3-1/2 inches.

2.1 CIRCUIT DESCRIPTION.

Figure 3 is a schematic diagram of the thermal relay receiver input protector unit. The antenna is normally disconnected from the receiver input when the 28-volt supply is off. When 28 volts is applied, the coaxial relay is energized through the thermal relay normally closed contacts. When the coaxial relay is energized, the antenna is connected to the receiver input through the series combination of contacts and the thermal relay heater element. However, should a high r-f voltage be included in the antenna, the excessive current developed will warm the thermal relay heater element sufficiently to cause its

contacts to open. This will remove the 28 volts from the coaxial relay causing it to become de-energized.

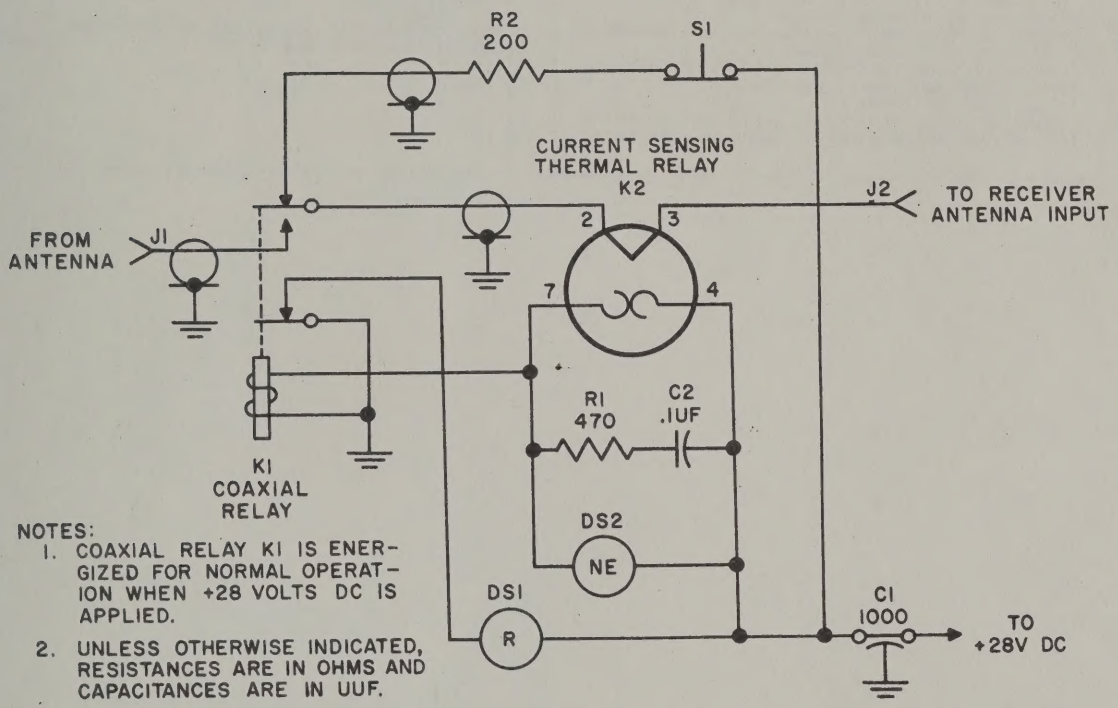
A new path will supply d-c current to the thermal relay in order that its contacts will stay open and keep the coaxial relay de-energized. This series path is from 28 volts through normally closed reset switch S1, resistor R2, the relay contacts, and the thermal relay heater to the receiver input, and within the receiver to a band coil and to ground.

The red indicator lamp will light to indicate that excessive current has been detected and to indicate that the antenna has been disconnected from the receiver.

The thermal relay contacts are protected from arcing by the series resistor R1 and capacitor C2 in parallel with neon lamp DS2 across the thermal relay contacts.

3.1 MAINTENANCE.

Before power is initially applied to the equipment and periodically thereafter, remove the junction box dust cover and the cover plate on the thermal relay receiver input protector unit. Check for cracks and checks of resistor and cables. Check coaxial connectors, and solder connections going to the protector unit and to the terminal boards. During inspection, remove accumulated dust with a vacuum cleaner or air hose.



C401-132-3

Figure 3. Thermal Relay Input Protector, Schematic Diagram

PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	JUNCTION BOX 153H-3	522-2363-005
C1	CAPACITOR, FIXED, CERAMIC: 1000 uuf, +80% -20%, 500 v dc	913-1292-00
C2	CAPACITOR, FIXED, CERAMIC: 0.1 uf, +80% -20%, 500 v dc	913-3152-00
DS1	LAMP, INCANDESCENT: 28 v, 0.17 amps; 0.430 in. dia by 1-3/16 in. lg max overall	262-3270-00
DS2	LAMP, GLOW: neon gas; 1/25 w, 65 v ac, 90 v dc; 1-1/16 in. h overall	262-0025-00
E1	LIGHT INDICATOR: red lens, frosted back; for use w/ T-3-1/4 miniature bayonet base bulb	262-0094-00
J1	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 rd female contact; 50 ohms; low loss plastic dielectric; straight shape (p/o W2)	357-9248-00
J2	CONNECTOR, RECEPTACLE, ELECTRICAL: UG-1094/U; type BNC; male, straight shape; panel mtg	357-9183-00
J3	CONNECTOR, RECEPTACLE, ELECTRICAL: same as J2	357-9183-00
K1	RELAY, ARMATURE: 1C contact arrangement; 100 w; 50 ohms, 1 amp at 28 v dc; 48 v dc nom; 900 ohms dc coil; continuous duty cycle	410-0219-00
K2	RELAY, THERMAL: 200 ma nom. heater current; 3 amp at 250 v ac; 0.6 sec time delay	402-0367-00
P1	CONNECTOR, PLUG, ELECTRICAL: 1 rd male contact; straight shape, 1 in. lg by 19/32 in. dia; brass silver plated (p/o W1)	357-9292-00
P2	CONNECTOR, PLUG, ELECTRICAL: same as P1	357-9292-00
P3	CONNECTOR, PLUG, ELECTRICAL: same as P1	357-9292-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
P4	CONNECTOR, PLUG, ELECTRICAL: same as P1 (p/o W2)	357-9292-00
P5	CONNECTOR, PLUG, ELECTRICAL: same as P1 (p/o W1)	357-9292-00
P6	CONNECTOR, PLUG, ELECTRICAL: same as P1 (p/o W3)	357-9292-00
R1	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%, 1/2 w	745-1338-00
R2	RESISTOR, FIXED, WIREWOUND: 200 ohms, ±5%, 5 w	747-5446-00
S1	SWITCH, PUSH: spst; ac or dc; 230 v ac at 7.5 amp 24 v dc at 17 amp	260-1263-00
W1	CABLE ASSEMBLY, RADIO FREQUENCY: 19 strands 0.0066 in. tinned copper wire, 50 ohms impedance (incls P3 & P5)	547-1329-002
W2	CABLE ASSEMBLY, RADIO FREQUENCY: 19 strands 0.0066 in. dia tinned copper wire, 50 ohms impedance (incls J1 & P1)	547-1328-002
W3	CABLE ASSEMBLY, RADIO FREQUENCY: 19 strands 0.0066 in. dia tinned copper wire, 50 ohms impedance (incls P6)	547-1327-002
XDS1	LAMPHOLDER: for miniature bayonet base pilot light bulb	262-1260-00
XF1	FUSEHOLDER: extractor post type; 500 v, 30 amp	265-1141-00
XF2	FUSEHOLDER: same as XF1	265-1141-00